THE IMPACT OF MANDATORY INSURANCE COVERAGE OF PREVENTIVE CANCER SCREENINGS ON CONSUMERS

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Abstract

This work seeks to understand the association between state and federal mandatory health insurance benefits and utilization of several preventive cancer screenings and the induced income transfers among consumers. The specific aims are: (1) to estimate the effect of state and federal mandated benefits of preventive care on use of cancer screenings; (2) to estimate how non-price barriers relate to compliance with screenings; (3) to quantify the income transfers induced by mandated coverage. The project studies two samples of beneficiaries: a sample of privately insured adults under age 65 are analyzed for utilization of cervical, prostate and colorectal cancer screenings respectively; another sample of Medicare fee-for-service beneficiaries who are 65 years of age and older are analyzed for consumption of prostate and colorectal cancer screenings.

Overall, the findings suggest that mandated coverage does not increase consumption of preventive care among privately insured adults, either in aggregate or for different demographic subgroups. Medicare coverage of prostate and colorectal cancer screenings are associated with increased fee-for-service claims billed for these services. Coverage mandates do result in income transfers from disadvantaged non-users to relatively well-off users of preventive care. Some non-price social determinants are associated with large redistributive effects, including being an Asian, less educated, lack of English proficiency and lack of usual source of care, and living in isolated areas without adequate physician supply.

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CHAPTER 1. INTRODUCTION

INTRODUCTION

The success of health care reform efforts depends on improving health outcomes and reducing health care expenditures. Preventive care is a key element of both these goals. Previous mandates and current health laws included incentives that aimed to encourage individuals to get routine preventive screenings. These screenings could ultimately help lower health care costs, because at least in many cases, treating a disease can be much more costly than prevention efforts. Despite this potential advantage, nationally people used preventive care at half the levels recommended by established guidelines (McGlynn et al., 2003). Preventive cancer screenings have been particularly underused in the United States compared to objectives set by Healthy People 2020 (Health and Human Services, 2011). Overall, 52.1 percent of adults aged 50 to 75 years received a colorectal cancer screening, below the target of 70.5 percent, and 84.5 percent of females aged 21 to 65 years received a cervical cancer screening, below the target of 93.0 percent (CDC, 2012).

Inadequate preventive care can lead to delayed diagnosis of medical conditions, as well as potentially greater use of medical resources and worse health outcomes. Studies have consistently indicated, for instance, that preventive cancer screenings increase life expectancy and reduce mortality. Early detection of colorectal (Pignone et al., 2002; Frazier, 2000; Maciosek et al., 2006) and cervical cancers (Schweitzer, 1974; Maciosek et al., 2006) also have been shown to be cost-effective. Benefits from receiving screenings at recommended intervals accrue both to individuals as well as to society. Yet,

historically these services have not been covered by typical insurance plans, as screenings are neither "medically necessary" nor catastrophically expensive (Schauffler, 2000). Even employer-sponsored insurance, which covers the majority of the insured non-elderly U.S. population (Blumenthal, 2006) has not always covered cancer screenings unless mandated to do so by state law (Bondi et al., 2006). Similarly, it was not until the early 1990s when some selected preventive care procedures (e.g. mammograms, flu shots) were added to Medicare's covered services, after the passage of the Omnibus Budget Reconciliation Act of 1990 (OBRA 1990).

It has been extensively documented that cost barriers and lack of insurance are key reasons why individuals do not receive preventive care (Buchmueller et. al, 2005; Hadley, 2003; Lurie et. al, 1987; Remler & Greene, 2009). The Patient Protection and Affordable Care Act (PPACA), passed in March 2010, included efforts designed to reduce disparities in preventive care consumption due to lack of insurance and cost barriers. The insurance coverage mandate has required individuals to carry health insurance, and the bill provides increased subsidies for insurance premiums, additional incentives for employers to provide health insurance coverage, and the development of "exchanges" through which small employers can obtain coverage and penalties for employers that do not offer coverage (Eibner, Hussey & Girosi, 2010). PPACA also addresses the affordability issue for insured individuals, by requiring health plans to cover preventive care that is recommended by the Preventive Services Task Force (USPSTF) at zero out-of-pocket cost (e.g., no copayments, coinsurance, or deductibles) (Koh et al., 2010). The latter mandate became effective on September 23, 2010. The mandated changes in benefit design are likely to have two relevant effects. First, there

will be increased demand for preventive care given the lower point-of-purchase price. Second, premiums will increase as a result of increased consumption of preventive care, decreased consumer cost sharing, discovery of more treatable illnesses and the subsequent treatment costs; and third, redistribution of resources from individuals who use less preventive care to those who use more.

Although PPACA introduces a seemingly dramatic change, in many cases the federal mandate is preceded by state laws and Medicare regulations requiring benefit coverage. Over the past two decades, states have gradually enacted a substantial number of mandates requiring private insurers[1] to cover preventive cancer screening tests, as indicated by medical practice guidelines or physician discretion. Medicare has also expanded Part B to cover preventive cancer screenings. For example, with the passage of the Balanced Budget Act of 1997 (BBA 97), Congress expanded Medicare to mandate coverage for certain preventive cancer screenings, including screening tests for colorectal cancer and prostate cancer, to reduce the cost burden among low-income populations. To remove cost as a potential barrier to the receipt of preventive care, the PPACA expands the scope of past state and federal legislations by mandating coverage of these services with no cost-sharing (USPSTF, 2013; Koh et al., 2010).

The primary rationale behind government intervention into coverage decisions in the private insurance market and Medicare program is that current screening rates may address an externality problem. To the extent that the cost of preventive care is borne by

[1] Per the ERISA of 1974, self-insured health plans, in which case the employer retains the risk for medical expenditures and uses the insurer to provide administrative functions, are not subject to state-level mandates.

employers and insurers, employee and enrollee turnover may result in sub-optimal investment in preventive care, because the returns from investment by one employer or health plan may accrue to a different employer or health plan (Herring, 2010). Mandating universal coverage of preventive care might allow these losses, if any, to be recovered. Secondly, the efficiency advantages of perfectly competitive markets rely on rational and well-informed consumers. However, consumers often are poorly informed regarding the benefits of cancer screening in particular (Finney Rutten, Nelson, & Meissner, 2004) and preventive care in general (Scott et al., 2002; Gazmararian et. al, 2005). Moreover, preferences toward treatment for immediate health concerns (Olsen, 1993) may result in myopic consumers placing a lower value on future benefits derived from receiving cancer screenings.

These recent federal and state legislative activities highlight the importance of understanding the relationship between mandatory insurance benefits and consumption of preventive cancer screenings. Are mandated laws effective strategies for encouraging greater use of recommended cancer prevention services? Similarly, which consumers are using these services and benefiting from the mandates?

The specific goal of this project is to investigate the overall effect on consumers of mandating preventive care coverage. My research aims are specifically: (1) to investigate the effect of state or federal policy intervention on change in consumption and premium increase; (2) to examine how demographic and access barriers relate to compliance with these screenings; and (3) to quantify the redistributive effects. In Chapter 2, I evaluate the effectiveness of state benefit mandates on increasing utilization

of three preventive cancer screenings—those for colorectal, cervical, and prostate cancer-- among privately insured nonelderly adults between 1997 and 2008. In Chapter 3, the effectiveness of Medicare coverage mandates for colorectal and prostate cancer screenings are examined among Medicare beneficiaries between 1992 and 2008. In addition, I estimate how demographic and access barriers relate to compliance with these screenings, and I quantify the redistributive effects as a result of the mandated coverage.

Cancer screenings are tests to detect cancers at an earlier stage, before they cause any symptoms. The cancer screenings in this project were selected as they reflect different levels of complexity and expenditures. Recommendations for all three screenings have been revised and debated in several guidelines, but more analysis and interpretation is needed to understand the relationship between policy intervention and the use of these screenings.

The project utilizes two naturally occurring designs – the natural experiment design generated from past implementation of state mandated benefits, and a pre-post design resulting from the Medicare mandate. Both closely resemble the ultimate ACA scenario. I compare consumption of specific preventive services in periods before and after the changes in state and Medicare coverage mandates, by analyzing individuals' behavior using multiple sources of federal and Medicare-specific survey data. These designs allow me to separate the effects of insurance coverage from other barriers to access for preventive care among the U.S. population.

Given the recent implementation of the PPACA mandates in 2010, it is still too early to fully evaluate their effect on behavior. However, given the resemblance of

PPACA mandates to existing state and Medicare regulations, this analysis can inform the discussion regarding PPACA's potential impact on behavior. In addition, findings from this study will reveal whether mandatory coverage of preventive cancer screening is effective to address market failures – if the mandate is a wise use of limited resources that results in positive net benefits to consumers.

LITERATURE REVIEW

There are good reasons to believe that health insurance status is one of the most important determinants of preventive care consumption (Hadley, 2003; Himmelstein & Woolhandler, 1995; Faulkner & Schauffler, 1997). Cost is a major reason why consumers reduce utilization of medical care, including both inefficient care (e.g. unnecessary services) and clinically important care like preventive services (Remler & Greene, 2009; Lohr et al., 1986). Specifically, higher cost-sharing was found to be associated with reduced utilization of preventive cancer screenings: higher levels of cost-sharing were associated with 13.6 percent fewer Pap smears for women aged 45-65 (Lurie et al., 1987). Other studies have found that cost sharing for preventive care in HMO and PPO plans reduces consumption of mammography screenings (Trivedi et al., 2008), cervical cancer screenings (Solanki, Schauffler & Miller, 2000) and prostate cancer screenings (Liang et al., 2004), compared with zero cost-sharing plans. Medicare beneficiaries in fee-for-service plans are usually responsible for a 20-percent co-payment for screenings such as Pap smears or mammograms. In contrast, Medicare HMOs or private supplemental plans typically do not require co-payments for preventive services. Previous studies have suggested that Medicare beneficiaries who purchased private supplemental plans were 50

percent more likely to undergo cancer screenings than those in traditional plans (Blustain, 1995), and that those in HMOs were an additional 10 percent more likely than those with supplemental coverage to undergo such screenings (Potosky et al., 1998). Thus, the price elasticity of demand for preventive care appears to be high. That means that reduction in the out-of-pocket price of preventive care is likely to increase demand. However, that increased demand also will result in higher premiums.

Mandated benefits of health services were previously found to increase insurance premiums for both individual and group health plans (Jensen & Morrisey, 2002; Parente et al., 2011). Therefore, one financial effect of mandated coverage is to shift the cost of preventive care from individual out-of-pocket costs to the premium, where the cost is shared by all enrollees. Whereas the higher premiums fall equally on all enrollees in a group health plan, only a portion of enrollees will actually consume the preventive care. Thus, as in all health insurance, those who use services will be subsidized by those who do not. The difference in the case of preventive care is that there is no element of risk associated with its consumption. Rather, consumption is largely predictable and at the discretion of the consumer. Currently, little is known about the redistributive effects of income transfers when individuals within an insurance pool share the same premium but consume discretionary health care services at different rates. Those transfers could reduce or even surpass the welfare gain from increased consumption of preventive care under the mandates.

In addition to cost, socio-demographic and cultural factors often translate into barriers to care. These factors include lack of access to a usual source of care

(Sambamoorthi & McAlpine, 2003), lack of physician recommendation (Klabunde, Schenck & Davis, 2006), transportation problems (Kiefe et al. ,1994; Stoner et al., 1998), skepticism regarding the efficacy of preventive care (Mcphee et al., 1997; Fiscella et al., 1998; Stoner et al., 1998; Katz et al., 2009) or skeptical views of health care providers (McAlearney et al., 2012), limited knowledge and health literacy (Parente et al., 2004; Scott et al., 2002; Lindau et al., 2002), and lack of English proficiency (Fiscella et al., 2002; Woloshin et al., 1997; Jacobs et al., 2005).

Some demographic factors are also associated with greater likelihood of receiving preventive cancer screening tests, including being married (German et al. 1995), being a female at a younger age (Rawl et al., 2000). In addition, there is a greater likelihood of consumption among people who engaged in health-maintenance behaviors, including trying to lose weight, exercising, not smoking, and having had previous cancer screenings (German et al., 1995; Lemon, 2001).

Socioeconomic status also affects consumption of preventive care. Individuals with less education and fewer economic opportunities (Sambamoorthi & McAlpine, 2003; Katz & Holfer, 1994) consume fewer preventive cancer screenings (Fiscella et al., 2000). Some research indicated certain minority groups, such as Asians and Hispanics, are less likely to undergo these screenings (Fiscella et al., 2000; Ananthakrishnan et al., 2007), while African Americans were more likely to undergo mammograms and pap tests (Paskett et al. 1997).

Finally, the local population and health care market characteristics influence whether people received the recommended preventive care. A higher supply of

physicians is associated with more use of cancer screenings (Ferrante et al., 2000; Roetzheim et al., 1999, 2001), and living in isolated areas (Casey et al., 2001; Coughlin et al., 2002) with inadequate physician supply (Ferrante et al., 2000; Roetzheim et al., 1999, 2001) leads to a decreased utilization. When out-of-pocket costs are reduced, consumers still may face these additional barriers to preventive cancer screenings.

It is beyond the scope of this project to evaluate the appropriateness of PSA testing for prostate cancer – rather, I approach the analysis of policy outcomes as historical evidence. However, it merits a review of the guidelines and debates to provide readers with relevant background. Researchers (e.g. ERSPC) have emphasized the importance of catching prostate cancer at an early stage and the benefits of the PSA tests to reduce mortality (Schröder et al., 2009). Others (e.g. PLCO randomized trial) have argued that finding prostate cancer may not improve health outcomes by reducing mortality (NCI, 2012). The follow-up tests and treatments from the false-positive results may even impose dangers. Although routine screening for prostate cancer has not been recommended by the USPSTF, other guidelines, including those by the American Cancer Society (ACS), had recommended prostate cancer screening until recent years (Smith et al., 2008; HHS, 1996). ACS had suggested that men over the age of 50, without a family history of prostate cancer, undergo an annual prostate-specific antigen screening, after a shared consultation with their doctors. The ACS, along with American Urological Association (AUA) and Centers for Disease Control and Prevention (CDC), revised their guidelines after the passage of PPACA in 2010, recommending that "starting at age 50, men make an informed decision with their doctor about whether to be tested for prostate cancer" (Smith et al., 2010). A younger age to start the discussion is recommended if the

individual has a higher risk of developing prostate cancers. However, the Mayo Clinic recommends "offering PSA screening and DRE annually to men ages 50 to 75 with a life expectancy greater than 10 years" and these tests are recommended earlier if individuals are at higher risks (e.g. African American males, or those with a family history of prostate cancer) (Mayo Clinic, 2013).

Although there is considerable research on preventive care, few studies have addressed the relationship between mandated benefits and individuals' cancer screening behaviors. Some studies have investigated the relationship between state mandates and other health services. For instance, minimum maternity stay mandates were found to increase the average postpartum length-of-stay (Udom & Betley, 1998; Liu et al., 2004). Analysts also have found mixed evidence regarding the effects of state mental parity laws (Harris & Carpenter, 2006; Klick & Markowitz, 2006) and the effects of infertility treatment mandates (Bitler & Schmidt, 2012; Bundorf et. al, 2007). Two recent studies using the Behavioral Risk Factor Surveillance System Survey (BRFSS) found a positive association between state mandates and mammography utilization (Bitler & Carpenter, 2011) and a weak association between mandates and colorectal cancer screening rates (Hamman & Kapinos, 2011), among people with insurance. These studies have not explicitly focused on the privately insured, who are most likely to be affected by the mandates. Moreover, prior research has not accounted for the potential diluting effects of mandates due to the ERISA exemption for self-insured employers. Lastly, the income transfers associated with state-mandated coverage have not been addressed by previous research.

Some studies have attempted to establish an association Medicare coverage and preventive cancer screenings, but they have been limited to specific U.S. states (Ko et al., 2002), for colon cancer screenings, or demonstrated the use pattern in post-coverage periods only (Blustein, 1995) for mammogram and for colon cancer screening (Harewood & Lieberman, 2004). As a result, we have no comprehensive view of the impact of nationwide health reform on a generalized Medicare population during the time before and after the onset of coverage. Moreover, there is a lack of understanding of the welfare effects of Medicare's preventive screening expansion. Thus, further economic research is needed to advance our understanding of critical issues pertaining to the allocation of limited resources to a targeted population for preventive consumption. This study is the first to explore the redistributive effects and income transfers induced by such laws. To do so, this study draws on the best available data to estimate the likely effects of ACA and to better understand potential barriers to consumption. Future work can utilize the proposed data infrastructure and methods to evaluate the impact of this federal policy change initiated in September 2010.

CHAPTER 2. THE EFFECT OF STATE BENEFITS MANDATE ON CONSUMERS

INTRODUCTION

To investigate whether mandated laws were effective strategies for encouraging greater use of recommended cancer prevention services, and to explore which consumers are using these services and benefiting from the mandates, this chapter examines the effect of past state benefit mandates on utilization of preventive colorectal, cervical, and prostate cancer screenings in the U.S. After outlining the structure and reviewing the relevant state mandates, this chapter introduces the study's primary data source, analytic methodologies, and sample selection criteria. Separate samples of privately insured adults were analyzed for each cancer screening. Major results are presented in Tables 1-3 and Figure 1. I further extended the examination to cover welfare change, considering the effect of state mandates in addressing the market failures.

BACKGROUND

The Patient Protection and Affordable Care Act (PPACA) of 2010 includes specific provisions to require coverage of certain USPSTF-recommended preventive cancer screenings in clinical settings[2] (Koh et al., 2010). Although PPACA introduces a seemingly dramatic change, in many cases the federal mandate is preceded by state laws requiring coverage. Over the past two decades, states have gradually enacted a substantial number of mandates requiring private insurers to cover preventive cancer screening tests,

[2] Grandfathered health plans — plans that existed on March 23, 2010-- are exempted under PPACA.

as indicated by medical practice guidelines or physician discretion. To remove cost as a potential barrier to the receipt of preventive care, the PPACA expands the scope of many state laws by mandating coverage of these services with no cost-sharing (USPSTF, 2013; Koh et al., 2010).

Prior to the PPACA, the American Cancer Society (ACS) recommendations were the most widely adopted set of guidelines used for drafting state mandates (Rathore et. al, 2000). By 2008, 27 states had adopted cervical cancer screening mandates and 28 states had screening mandates for colorectal cancer. Despite the controversies over early detection of prostate cancer (Barry 2009), 33 states had mandated coverage for the prostate-specific antigen (PSA) screening too. State mandates are typically applicable to fully-insured individual and group health plans. Self-insured health plans, which are predominantly offered by large employers, are exempt under the Employee Retirement Income Security Act of 1974 (Fernandez, 2010; Park, 2000).

This study utilizes a nationally representative sample of privately insured adults and a difference-in-difference (DID) estimation strategy to evaluate the effectiveness of state benefit mandates on increasing utilization of three preventive cancer screenings between 1997 and 2008: those for colorectal, cervical, and prostate cancer. Notably, the effectiveness of the mandates could vary by type of screening, since the tests differ in both level of complexity and potential out-of-pocket price to the consumer. In addition, I estimate how demographic and access barriers relate to compliance with these screenings, and I quantify the redistributive effects of mandated coverage between users and non-users.

The study addresses the disparities in consumption of preventive cancer screenings, controlling for insurance coverage and state mandates, in order to address the discrete access barriers related to preventive care-seeking for the U.S. adult population. It is the first study to characterize users and non-users of cancer screenings in states with mandates and to explore the income transfers induced by such laws.

METHODOLOGY

Data

The primary data source is the 1997-2008 Medical Expenditure Panel Survey (MEPS). The MEPS is a nationally representative sample of the U.S. civilian non-institutionalized population. It includes information on the subjects' demographics, socioeconomic characteristics, and insurance status, as well as information on access to and utilization of medical care (AHRQ, 2000). MEPS uses an overlapping panel design of five rounds over two years, in which preventive care related data are collected in Rounds 3 and 5. I augmented the MEPS data with geographic-specific information from the Bureau of Health Profession's Area Resource File (ARF) on local physician supplies. Data on preventive benefit mandates were retrieved and documented by the author from multiple sources, including the National Cancer Institute's State Cancer Legislative Database (SCLD) Program, the National Council of State Legislatures (NCSL), the Council for Affordable Health Insurance (CAHI), the Blue Cross Blue Shield Association (BCBS), and each state government's public records. Preventive benefit mandates were linked to MEPS respondents by their state of residence and year. Unfortunately, MEPS does not collect detailed information on the price of preventive cancer screenings.

Instead, to price colon and prostate cancer screenings, we used the national average insurer-paid price listed on Healthcare-Blue-Book.com, a public access website that synthesizes data from providers, payers, and billing agencies to determine a reference price paid by insurance plans to physicians. Since Healthcare-Blue-Book.com does not report prices for cervical cancer screening, we rely on Medicare Part B reimbursement rates for this information.

Sample

The study sample for each of the cancer screenings consists of privately insured adults under age 65, who as of 2008 also meet other age and gender-specific criteria indicated by the ACS guidelines (Table 1). We excluded persons enrolled in Medicare (6.2% of sample) or Medicaid (9.5% of sample) during any month of the survey year, because mandated benefits typically apply to employer-sponsored or individually purchased private plans. Using the MEPS Medical Conditions file, I identified individuals with a prior diagnosis of cervical, prostate, or colon cancers, and also excluded them from the sample to gauge on the preventive utilization of the procedures.

Empirical Strategy

For each cancer screening, I specified a model corresponding to the probability that an individual received the recommended care, and estimated the model via binary logistic regression (Equation 1). In the analyses, I used MEPS person-level weights and clustered the standard errors at the individual respondent level, to account for the

complex survey design and for the fact that same person may be observed twice during the survey period.

$$Equation(1):$$
$$P(Y_{ijt}=1 \mid X_{ijt}) = F(\beta_0 + \alpha Post_t + \delta Treat_j + \chi(Post_t \times Treat_j) + \gamma X_{ijt} + \eta YearDummies + \mu_{itj})$$

The outcome variable $P(Y_{ijt}=1 \mid X_{ijt})$ represents the probability that individual *i* from state *j* reported a given screening procedure during year *t*. By 2008, the ACS guideline recommended annual Pap tests for cervical cancer for women 18 years of age and older, and recommended annual PSA tests for prostate cancer for men 50 years of age and older (ACS, 2008). The guideline also recommended people 50 years of age and older to have an annual Fecal Occult Blood Test (FOBT), paired with a sigmoidoscopy every five years or a colonoscopy every ten years, for early detection of colorectal cancer (ACS, 2008)[3]. The survey question asks the respondent when the last colonoscopy or sigmoidoscopy was done, at intervals of within 1 year, 2 years, 3 years, 5 years, or more than 5 years. This design limited the accuracy of the reported frequency of colonoscopy screening. In this study, individuals were considered compliant if they reported having either a colonoscopy or sigmoidoscopy within the past five years.

One strength of this study is that state mandates went into effect at different times, a variation that allows the effect of the mandates to be separated from general secular trends in preventive care utilization. For example, while some states had adopted cervical cancer screening mandates in the late 1980s, others never enacted them. Figure 1

[3] ACS recommended more frequent screenings for patients at higher risk of developing cancers—those with family history or relevant disease history (ACS, 2004). We are unable to separate the average risk patients from the high risk patients due to the limited survey questions.

provides a map to illustrate this variation. Similar patterns are observed for prostate and colorectal cancer screening mandates. I used a differences-in-differences (DID) model to estimate the change in utilization of preventive screenings due to state-mandated benefits. The treatment states in this context are those that passed a mandate benefit law during the observation period. The mandate timing was lagged one year following enactment, to allow the mandate to go into force for the following enrollment period. Post-mandate periods represent the years following adoption of the mandates. In order to incorporate control states (those states that did not mandate coverage during the observation period) into the DID model, the control states were assigned "pseudo-mandate years" drawn randomly from the same distribution as actual mandate years for the treatment group. State mandates that applied *only* to health maintenance organizations (HMOs) were not considered in this study[4].

Explanatory variables X_{ijt} represent the respondent's demographic attributes, socio-economic status, and barriers to health care (Table 1). For instance, lack of English proficiency is represented by the respondent using a language other than English during the survey. Having a usual place of care means that the individual indicated that there was a particular doctor's office, hospital, or other place that he or she usually went for health related issues. In addition, X_{ijt} includes variables that represent local physician availability. These include the rates of primary care physicians, gastroenterologists, and OB-GYNs per 100,000 people. A set of year dummies were included to capture the secular trend in utilization.

[4] Most state mandates applied the laws to individual and group plans, including HMO plans. Overall, only 15%-25% of MEPS survey respondents reported having HMO coverage across different years.

The incremental effect of state mandates is captured by the average marginal effects (AME) of the interaction term $Treatment \times Post$. The marginal effect of the interaction term is computed as the difference in the predicted probability of consumption of preventive care in the pre- and post-mandates periods, for the treatment group relative to the control group (Karaca-Mandic, Norton & Dowd, 2011). Robust standard errors account for the autocorrelation in the panel data.

To examine the impact of other barriers and to quantify disparities in utilization among individuals with different socio-demographic characteristics, I estimated a second binary logistic regression to distinguish the users of care from non-users in states with implemented benefit mandates.

RESULTS

Characteristics of Study Sample

Table 1 summarizes the characteristics of the study sample of privately insured, non-elderly adults that meet the age and gender criteria for ACS recommended colorectal, cervical, and prostate cancer screenings. Relative to the overall U.S. non-elderly population, individuals within the sample were characterized as having higher educational attainment and income, and are more likely to be white and married (Census, 2000). The majority of respondents had a usual place of care, although approximately 15% of them reported using a hospital or emergency room. Individuals who obtained cancer screenings had higher educational attainment and income, were more likely to live in urban areas, and lived in counties with a higher physician to population ratio.

Effects of State-Mandated Benefits

Table 2 shows the marginal effects and standard errors for the explanatory variables on the probability of using each type of preventive cancer screening. There is no statistically significant relationship between a person living in a state with a mandate and his or her probability of receiving an endoscopy within the past five years, receiving an annual Pap test, or receiving an annual PSA following the enactment of state mandates. Relative to year 2000, years 2001 to 2008 saw increases in the utilization of colorectal cancer screening, but this was not true for the other screenings. This finding is interesting, yet not surprising. During this time period, there was an increasing emphasis on public education for colorectal cancer screening at both the state and federal level, e.g. CDC's Screen for Life: National Colorectal Cancer Action Campaign.

One possible reason for finding no effect of benefit mandates is that most health plans had already adopted them prior to the law going into effect (Klabunde et al., 2004). Alternatively, there may be non-financial barriers reducing individuals' propensity to obtain screenings. In the model, we found several other explanatory variables to be significantly associated with the likelihood of obtaining a preventive cancer screening. For example, females were less likely to undergo an endoscopy (-2.53 percentage points), relative to males. We observed that as a person ages, he or she was more likely to use an endoscopy test (1.68 percentage points), but not a Pap test (-0.22 percentage points). Also, having a usual place of care was associated with an increase of about 20 percentage points in the probability of using an endoscopy and PSA, and a 12 percentage-point-increase in the probability of getting a Pap test. Living in an urban area also related to

screening: urban residents were more likely to have an endoscopy or a Pap test (3.48 percentage points and 2.77 percentage points, respectively). Other strong indicators of lower use of an endoscopy included being Asian (-12 percentage points), having lower income, or lacking English proficiency (-9 percentage points).

Robustness Checks

I estimated several different specifications to check the robustness of the null results found in the baseline model. As reported by Eibner et al. (2011), self-insurance increases with employer size: the majority of firms with 1,000 or more employers offer self-insured plans, as do nearly half of firms with 200-999 employees. To test the effect of self-insurance, I limited the treatment group to subjects covered by insurance from small employers, defined as single-location establishments with fewer than 200 employees and fewer than 100 employees, respectively, in separate robustness tests. The DID effects from these samples were also not statistically significant, suggesting that ERISA exemptions cannot explain the original null finding.

Second, I estimated several DID models to test for the possible effects of state mandates across different demographic and socioeconomic groups, based upon different ages, sexes, races, and income levels. The model was re-estimated for each subgroup of interest. State mandates were not found to have a statistically significant effect on utilization of cancer screenings for most subgroups. However, marginally significant results were found for cervical cancer screening for women aged 30-34 (marginal effect = 12.70 percentage points; P=0.10) and 35-39 years old (marginal effect = 9.71; P=0.10). I consider the mandates impact as insignificant in the remainder of our analysis, as these

effects failed to achieve significance at $p<.05$. However, this finding merits further attention, as mandates might introduce different cancer prevention behavior changes among certain age groups relative to others.

To examine whether recall bias might be influencing the results, I estimated the probability of endoscopy use within the past year only. Mandates were not found to have an impact. Finally, to allow for different screening strategies to respond to state mandates differently, I performed robustness tests using alternative measures of screening. Specifically, I separately modeled receipt of an annual FOBT for colon cancer screening, and I modeled receipt of a Pap test within every two years and every three years (versus annually). Again, our null finding remained robust.

Analysis of income transfer

Coverage of preventive services is fundamentally different from the traditional insurance coverage of illness in two ways. In the case of medically necessary health care, private insurance is purchased as a "voluntary quid pro quo exchange" to obtain extra income when ill (Nyman, 2001). Purchase of a state-mandated benefit for preventive cancer screenings is not voluntary since it is incorporated into the premium, but utilization of a particular service remains at discretion of the consumer.

Another difference roots in the fact that preventive services are not medically critical, therefore decision to purchase the care is individualized. While transferring income from the healthy to the sick is the purpose of health insurance, true insurance is a term that applies only when all individuals in the pool face the same risk of experiencing

the illness or injury. In contrast to most illnesses and injuries, there is no risk associated with consuming preventive care. As discussed earlier, the decision to consume preventive care is likely to be affected by a person's demographics, social networks, and community. Even when state mandates do not change the consumption level, mandated coverage converts the cost of preventive care from an out-of-pocket cost to a premium increase. The cost of preventive care is no longer borne solely by the individual, but by all individuals in the risk pool, resulting in a transfer of income from those who are less likely to consume the care to those who are more likely to consume it. Otherwise, there is a redistribution of income from the systematically low risks to the systematically high risks that is very different from the income transfers associated with the random occurrence of illness among individuals with the same risk probability.

The lack of risk associated with the consumption of primary care and the systematic differences in the probability of consumption among different types of consumers raise two important policy questions: (1) what are the characteristics of users and non-users for the services included as part of these mandatory benefits? (2) How large are the potential income transfers from one subgroup of people to another? The transfers of interest in this analysis are among subjects all eligible for the same service. Transfers between eligible and non-eligible enrollees (e.g., the subsidy of Pap smears by males or PSA tests by females) are not considered.

How large are these transfers? To investigate this question, I used logistic regression to examine the characteristics of users and non-users of preventive cancer screenings, among individuals who were exposed to the state mandates in the post-

mandate periods. Thus, preventive care was a covered service for all individuals in this sub-sample. Table 3 presents the marginal effects and standard errors. The effects of some characteristics, such as higher education, non-Asian, and having a usual place of care, are consistently positive across all three types of screenings. In particular, lack of English proficiency is associated with an 8 percentage point reduction in the likelihood of receiving an endoscopy, while a larger supply of gastroenterologists increases the probability by nearly 3 percentage points (0.82% * 3.34=2.74%). Being married is associated with increased consumption of Pap tests and PSA tests among women and men, respectively. These findings suggest that disparities in consumption persist regardless of state mandates. The positive effect of income on consumption of preventive care suggests that mandated benefit laws are regressive, transferring resources from insured individuals with lower incomes to those with higher incomes.

To simulate the amount of the transfers, suppose that all the subjects in our sample are in the same insurance pool across all states and all years. Assume further that no health plan covered preventive care prior to the mandate, and that all health plans cover 80%[5] of the insurer's price after the mandate goes into effect.

First Approach: Redistribution of Income from Non-Users to Users

There are three groups of interest: (1) individuals who would consume preventive care regardless of the mandate, (2) individuals who would not consume preventive care

[5] The majority of state mandates required a cost-sharing of our examined cancer screenings as other outpatient services in a standard plan. We arbitrarily picked a common coinsurance rate of 80%. Under PPACA, USPTF recommended cancer screenings must be covered without copayments, co-insurances, or meeting deductibles.

regardless of the mandate, and (3) individuals who are induced to consume preventive care by the onset of the mandate. I found that mandate laws did not increase utilization, so I assume that there are no individuals in the third group.

Individuals in the first and second groups face a higher premium after the coverage is mandated. But individuals who would have obtained the screenings regardless of the mandate enjoy a post-mandate subsidy by non-users of preventive care in the post-mandate period. Individuals who would not consume preventive care regardless of the mandate gain no benefit from the mandate, but still pay for the consumption of users through higher premiums.

A simple "back of the envelope" exercise allows us to quantify the magnitude of these transfers. The increase in premiums resulting from mandated coverage of preventive care is the product of the level of consumption of preventive care, the insurer's unit price, and the insurer's share of the total amount (80%). For instance, the national average insurer-paid amount for a colonoscopy without biopsy, performed in an outpatient surgery center, consists of two parts: a physician fee ($476) plus a facility fee ($643), which sums to $1,120 in total (Healthcare Blue Book, 2012a).

In the data, 39 percent of consumers[6] in the post-mandate period got a colonoscopy within the past 5 years when they were exposed to state mandates. If we think of the sample as a pool of insured individuals for this exercise, then mandated coverage of colonoscopies would increase premiums for everyone by $1,120× 0.39=

[6] On average, there was no change in consumption due to state mandates.

$437. On an annualized basis, $87 ($437/5) is the amount of the transfer from non-users to users. Assuming a PSA test ($23) (Healthcare Blue Book, 2012b) or a conventional Pap smear ($39) (American College of Physicians, 2003) is done at the physician's office for an established patient (Level 2 visit, $71) (Healthcare Blue Book, 2012c), the mandated coverage would increase premiums for the relevant individuals by $47 ($94× 0.50), and by $76 ($110× 0.69), respectively. Even though payments for Pap smears or PSA tests are modest compared to a colonoscopy, the aggregate transfer in the long term could be significant.

Second Approach: Redistribution of Income Based on Probability of Utilization

The above approach considers the *average* users and non-users as two groups. Approaching the same income transfer problem with the individual's point of estimate, I calculate the subsidies and income transfers using the predicted probability of utilization of each individual in the sample of colonoscopy. That allows me to easily calculate the income transfers of different subgroups. The income transfer is estimated by the following steps: (i). Characterize the beneficiaries who are more likely to receive a colonoscopy; (ii). Calculate the subsidy each sub-groups of beneficiaries received because of the coverage, based on their personal predicted probability of utilization; (iii). Calculate the share of increased premium each beneficiary paid out of pocket, with respect to the average predicted probability of utilization across years; (iv). The difference between subsidies and premiums are the net income transfers.

The income transfer is estimated by:

$$Transfer_i = Subsidy_i - \Delta premium = \Delta price \times phat_i - \Delta price \times \overline{Q}$$

where $\Delta price$ is price reduction for beneficiaries ($1120*80%), $phat_i$ represents personal predicted probability of consumption for individual i based on characteristics, and $\overline{Q}$ is the average consumption in the post coverage pool $\overline{phat_i}$ (0.39).

On average, the premium increases by $ 353.74, this annualizes to $70.75 per beneficiary. However, beneficiaries are not likely to receive income transfers equally with the insurance mandates in effect. The analysis indicated that those who had additional access barriers received fewer subsidies from the program (Table 4). Beneficiaries who are better off in terms of socio-demographic characteristics would receive more income transfers than those who are worse off.

For example, beneficiaries who are categorized into low and mid income categories would receive only negative income transfers (-$107 and -$80, respectively), suggesting that they pay higher premiums to subsidize beneficiaries who fall into higher income categories. Similarly, those who lack English proficiency would receive -$160 net income transfer. Beneficiaries who did not attain a college degree would receive much less subsidies and negative income transfers: -$46 net income transfer on average for those who attained only high school degrees, and -$167 for those who did not complete high school. Those advantageous characteristics interact with the amount of subsidies and income transfers, which suggests that the state mandates are regressive policies that subsidizing beneficiaries who are better-off.

CONCLUSION

I do not find evidence to suggest that state-level benefit mandates resulted in increased rates of cancer screening. I do find, however, that mandated coverage can result in income transfers that are likely to be regressive and significant. Some individual and social determinants are associated with large redistributive effects, including being an Asian, less educated, lacking a usual source of care, and having less availability of physicians in the community.

CHAPTER 3. THE EFFECT OF MEDICARE COVERAGE ON CONSUMERS

INTRODUCTION

In the previous chapter, I inquired how state-mandated benefits of preventive cervical, prostate, and colorectal cancer screenings relate to consumers' behavior among the privately insured, non-elderly population. I found that insurance regulations at the state level were not effective in increasing these screenings. In line with the discussions earlier, this chapter examines the role Medicare legislation has played in promoting preventive cancer screenings in the United States. In this study I focus on two recent benefits expansions, as a result of the passage of Balanced Budget Act of 1997: the expansion of Medicare Part B to include coverage of colonoscopy and prostate-specific antigen (PSA) tests for fee-for-service (FFS) beneficiaries 50 years of age and older.

I start this chapter by outlining the structure and relevant benefits of Medicare Part B, followed by an introduction of the data source, analytic methodologies, and sample selection criteria. Separate samples of Medicare beneficiaries are analyzed for each cancer screening. Major results are presented in Tables 4-8 and Figures 2-11. I further extend the examination to the distributional effects of benefits expansion, considering the subsidies received by beneficiaries with different utilization characteristics.

Generally, the available data cannot determine a causal relationship between the expansion of Medicare coverage to include screening colonoscopy and PSA test and the utilization of these services. However, I can examine the relationship between the

reimbursement change and increased amount of tests prescribed for *multiple reasons* (i.e., both preventive and diagnostic reasons) that were observed in Medicare claims data. The results suggest that certain demographic characteristics, socio-economic characteristics, and health behaviors are also strong indicators of receipt of care. Importantly, the analysis again reveals the redistributive effect of policy interventions: income was transferred from beneficiaries who have forgone the care to those who pursued it and from worse-off to better-off beneficiaries.

BACKGROUND

Medicare is a federally funded health insurance program. Since its enactment on July 30, 1965, Medicare has provided health care coverage to the elderly reaching age 65, and later began to provide coverage to people with disabilities and with ESRD under age 65. Under Title XVIII of the Social Security Act (SSA), the earlier Medicare program provides hospital insurance (Part A) for inpatient care, and optional medical insurance (Part B) for outpatient and other "medically necessary" health services. Over the decades, Medicare has expanded Part B to cover physician visits, outpatient hospital services, preventive services, laboratory and x-rays, and other ambulatory services. These services include cancer diagnostic or therapeutic procedures. With the passage of the Balanced Budget Act of 1997 (BBA 97), Congress further expanded Medicare to mandate coverage for certain preventive cancer screenings, including screening tests for colorectal cancer and prostate cancer, to reduce the cost burden among low-income populations.

Congress had regularly voted to set Part B premiums at 25% of program costs since the early 1980s. General revenues (e.g. from federal taxes) covered the remaining

75% of program costs. BBA 97 permanently set the premium at 25% to cover the program costs. The premium rises or falls according to the increase or decrease of Part B costs. The only exceptions were years 1991-1995, when the Omnibus Budget Reconciliation Act of 1990 (OBRA 90) set premiums at specific dollar amounts, based on what 25% of program costs were projected to be in five years. Until the passage of the Medicare Modernization Act of 2003 (MMA 03), all Part B enrollees had paid the same Part B premiums, regardless of their income level. The MMA increased the Part B premiums for higher income enrollees beginning in 2007, and fully phased-in over five years. The Part B deductible had been $100 since the early 1990s. It was raised to $110 in 2005. In subsequent years, MMA specified the deductible to be increased by 25% as with the Part B premium.

Majority beneficiaries enroll in a traditional Medicare fee-for-service (FFS) plan, with other insurance to supplement their Medicare benefits. The supplemental plans vary by sources, including private Medigap policies and employer-sponsored retiree coverage, and the public insurance program Medicaid. The Medigap policy helps cover Medicare's traditional fee-for-service out-of-pocket expenses (e.g. cost-sharing requirements) and provides additional coverage for services not included in FFS plans. The share of employer-sponsored insurance has fallen since the late 1980s as health care costs have risen (Cunningham et al., 2008). For example, the share of employer-sponsored insurance among the Medicare population dropped from two-thirds in the late 80s to one-third in 2008 (Cubanskik et. al, 2010).

Medicare Legislation to the Coverage of Preventive Cancer Screenings

The Balanced Budget Act (BBA) of 1997 made significant changes in the Medicare program. In particular, the legislation established coverage of certain screening tests under Medicare Part B for early detection of colorectal and prostate cancer, subject to defined frequency and reimbursement limitations (Table 4). Effective on January 1, 1998, Medicare started to provide coverage for four preventive colon cancer screenings, under Section 4104 of the BBA, for patients age 50 and over (Federal Register, 1997). Specifically, these screenings are (Table 4):

(a). Annual fecal occult blood tests (FOBTs) ordered by a physician. This test does not directly detect colon cancer but it checks for hidden blood in the stool. Positive tests indicate the need of further investigation for polyps or cancerous growths.

(b). A flexible sigmoidoscopy that is used to check for polyps or cancer in the rectum and the lower third of the colon, given every four years for beneficiaries. For average risk beneficiaries who had a colonoscopy within the past 10 years, Medicare only covers a flexible sigmoidoscopy after at least 119 months have passed following the month that the screening colonoscopy was performed.

(c). A screening colonoscopy to check for polyps or cancer in the rectum and the entire colon, given every two years for beneficiaries at high risk for colorectal cancer (e.g. a personal history of colon cancer) and every 10 years for average risk patients (or four years after their last flexible sigmoidoscopy). This is the

most expensive and invasive screening, and may require anesthesia or sedation. Some polyps and early cancerous growths can be removed during the procedure.

(d). A barium enema as an alternative to a flexible sigmoidoscopy or colonoscopy, as determined by the physician.

Beneficiaries do not pay out-of-pocket for FOBTs. For the other tests, 25% of the Medicare-approved amount is required after the yearly Medicare Part B deductible is met. A flexible sigmoidoscopy or colonoscopy may lead to removal of polyps during the procedure or the follow-up biopsy, which require additional charges. The BBA of 1997 first limited required coverage of screening colonoscopy to beneficiaries who were at high risks of developing colon cancer. This benefit was later expanded to include patients at average risk, with procedures every 10 years, effective July 1, 2001 (Chaikind & Tilson, 2001).

Under Section 4104 of BBA, Medicare started to cover two tests for the early detection of prostate cancer, including the annual digital rectal examination and annual prostate specific antigen (PSA) blood test for men who have attained age 50. The PSA is a blood test that measures the level of PSA, a protein produced by cells of the prostate gland, in a man's blood. Until recently, many doctors encouraged annual PSA screening for men beginning at age 50. PSA testing had reached its popularity in the late 90s since it was FDA patented in 1994. Although there is widespread caution against routine population screening, Medicare continues the coverage for yearly PSA screening. The DRE is a clinical examination of an individual's prostate for abnormalities, such as swelling and nodules of the prostate gland (NCI, 2012). The PSA test is provided at no

cost to Medicare beneficiaries, but Part B deductibles and coinsurance apply to the DRE procedure. Despite the fact that some public medical guidelines (e.g. those from USPSTF 2008) recommend against screening cancers for very old patients (e.g. those over 75), Medicare continues to pay for preventive cancer screenings without leaving out the oldest of the elders.

METHODOLOGY

Data

This study analyzes the Medicare Current Beneficiary Survey (MCBS) data in years 1992-2008. The MCBS Access to Care component surveys a nationally representative sample of household Medicare beneficiaries, including both the aged and disabled. It is a continuous, short panel where sampled beneficiaries are interviewed three times a year for up to four years. This is the most comprehensive data that documents Medicare beneficiaries' demographics, socio-economic status, access to care, satisfaction with health care, insurance sources, and health care utilization.

Sponsored by the Centers for Medicare and Medicaid Services (CMS)[7] , MCBS is a unique survey that can be linked to the CMS administrative billing data (Eppig & Chulis, 1997). I augmented the Access to Care data with the administrative claims[8] by (encrypted) beneficiary identifier and year, to obtain a more complete and accurate record of care utilization and payments. The supplemental claims files provide us the nature of

[7] CMS was previously known as the Health Care Financing Administration (HCFA), so the files were also referred to as HCFA claims.
[8] The records in the MCBS Medicare administrative files were previously selected and made linkable to MCBS Access to Care by CMS.

and reason for billed service for each survey respondent, the dates of services, and the Medicare-approved reimbursement amount. My analysis draws information from both carrier claims and outpatient claims. Each claim includes a Health Care Procedure Classification Code (HCPCS) to describe the billed service, accompanied by an ICD-9 diagnosis code indicating the reason for the service. However, I am only able to obtain the billing information for Medicare FFS-covered services. Medicare-managed care plans pay for services through a capitated payment scheme, and self-purchased supplemental private insurance vary their benefits across plans. Consequently, these billings are not submitted to CMS and the likelihood is very small that we would capture these claims' records in our study.

Study Sample Selection

For each cancer screening, the study analyzes a sample of non-institutionalized beneficiaries who enrolled in the Medicare Part B fee-for-service plan for all the entire calendar years. The study sample is drawn from matching MCBS Access to Care survey to the linkable Medicare carrier claims and outpatient claims. The sample is restricted to beneficiaries who were aged 50 and older and met the gender requirement, as specified by the "Guide to Medicare Preventive Services for Physicians, Providers, Suppliers, and Other Health Care Professionals" (CMS, 2005), for the colorectal and prostate cancer screenings, respectively.

In addition, the study sample for colonoscopy consists of FFS beneficiaries who did not have a record of a total colectomy. I further eliminated beneficiaries who had a self-reported personal history of colon cancers, a claims-documented family history of

gastrointestinal cancer[9], presence of colon cancers, chronic digestive diseases, or inflammatory bowel diseases in a given year (CMS, 2005), as screening tests furnished on these beneficiaries are very likely surveillance colonoscopy. For PSA screening, I identified a sample of male beneficiaries who were 50 years and older, without a record of a prostatectomy (Table 6).

Using Social Security administrative records maintained by CMS (Access to Care Component RIC A), I excluded Medicare beneficiaries who also qualify for the Medicaid benefits, referred to as "dual eligibles" (12.84%). The Medicaid state "buy-in" programs provide varying levels of help to the dual-eligible beneficiaries to pay their Medicare premiums, fill cost-sharing requirements, and in some instances pay for benefits not covered by Medicare FFS. To gauge the effect of Medicare benefit change on utilization, the exclusion criteria apply to those who enrolled in "buy-in" programs at any time during the observation year, including the QMB (Qualified Medicare Beneficiaries), SLMB (Specified Low Income Medicare Beneficiary), and QI-1 and QI-2 (Qualified Individuals 1 and 2) programs. Further excluded were beneficiaries who obtained their Medicare benefits from managed care plans[10] (a.k.a. Medicare Part C, Medicare+Choice plans, or Medicare Advantaged plans) (13.83%), which commonly feature reduced cost-sharing of Medicare services, reduced premiums, and extra benefits beyond FFS plans (Cubanskik et al., 2010).

[9] The family history of cancers or gastrointestinal disease is not well documented in Medicare claims. I used ICD-9 codes "V16.0", a widely used coding to identify a family history of "malignant neoplasm of gastrointestinal tract." It only captured a very small amount of observations (Benarroch-Gampel et al., 2012).

[10] Medical claims for Medicare managed care plans are not available for research purposes.

Empirical Strategy

This study takes advantage of a pre-post design, naturally formed by the fact that Medicare preventive coverage became available to all eligible beneficiaries at the time coverage of benefits went into effective. I estimated the effect of the change in reimbursement policies on the probability of receiving colonoscopy/PSA test that were furnished for any medical reasons, using logistic models for colorectal and prostate cancer respectively. To improve its statistical power, the model is estimated based on a person-year unit of analysis. The logistic regressions were weighted by cross-sectional sample weights and clustered by person, to account for the complex survey design and the nontrivial overlapping sample (the repeated observations on the same beneficiary). Robust standard errors account for the autocorrelation in the panel data.

An interrupted time-series model was specified to analyze the association between the Medicare mandate and utilization of each cancer screening. The interrupted time series (ITS) model divides the regression model into pre- and post- intervention segments (Equation 1). To investigate whether onset of Medicare coverage results in change in utilization, I am testing the differences of two parameters: the "intercept" and "slope" of a regression model. A change in the intercept between the pre- and post- intervention segments indicates a step-change, and a change in slope indicates a change in trend. The time trend is captured in the regression line, as the ITS compares intercept and slope before the universal coverage with the intercept and slope afterwards.

$$Equation(1): P(Y_{it}=1 \mid X_{it}) = Logit(\beta_0 + \beta_1 Coverage_t + \beta_2 Time\_after_t + \beta_3 X_{it} + \beta_4 Year_t + \mu_{it})$$

In this model, β_0 estimates the baseline level of the outcome. β_1 estimates the change in the intercept when the mandated coverage became effective. $Coverage_t$ equals to 1 if beneficiaries were surveyed in the post mandate period. *Year* is a continuous variable indicating calendar years since 1992. $Time\_after_t$ is a continuous variable indicating the *number* of years after mandate and is coded as zero before the mandate. μ_{it} addresses random error and autocorrelation. The incremental effect of Medicare coverage is captured by the average marginal effects of $Coverage_t$.

The outcome variable $P(Y_{it} = 1 | X_{it})$ represents the probability of receiving a screening colonoscopy or PSA testing in a given calendar year. MCBS does not have a panel long enough to model the recommended 10-year screening interval of colonoscopy. X_{it} includes variables that describe demographic and socio-economic characteristics, health behaviors, and takes into account certain facets of patient-physician interactions. One of the X_{it} variables captured whether the beneficiaries supplemented a Medicare FFS plan with any privately purchased insurance, including Medigap, individual, or employer-sponsored insurance[11]. I assessed two scales from the MCBS Access to Care survey on medical care quality delivered by physicians; both scales describe the relationship between providers and patients. "Distrust doctors or their expertise" reflects patients' confidence in their doctors' professional skills, and "Lack of communication with doctors" indicates that patients were not satisfied with doctors'

[11] It is not feasible to distinguish these private insurance sources in MCBS.

interpersonal skills or information giving, which suggests an insufficient patient-centered communication.

The full analytical models (Equation 2 & Equation 3) allow the effect of Medicare coverage to differ as a function of private supplemental insurance (80% of sample), as $Suppl\_ins_i$ changes from 0 to 1. Because supplemental insurance helps to pay for Part B coinsurance and deductibles, these eligible beneficiaries with extra coverage should have a flatter demand curve than the rest following the Medicare coverage.

$$
\begin{aligned}
&Equation(2): \\
&P(Y_{it}=1 \mid X_{it}) = Logit(\beta_0 + \beta_1 Coverage98_t + \beta_2 Coverage01_t \\
&+\beta_3 Time\_after98_t + \beta_4 Time\_after01_t \\
&+\beta_5 Coverage98_t \times Suppl\_insurance_i \\
&+\beta_6 Coverage01_t \times Suppl\_insurance_i \\
&+\beta_7 Time\_after98_t \times Suppl\_insurance_i \\
&+\beta_8 Time\_after01_t \times Suppl\_insurance_i + \beta_9 X_{it} + \beta_{10} Year_t \\
&+\mu_{it}
\end{aligned}
$$

$$
\begin{aligned}
&Equation(3): \\
&P(Y_{it}=1 \mid X_{it}) = Logit(\beta_0 + \beta_1 Coverage00_t + \beta_2 Time\_after00_t \\
&+\beta_3 Coverage00_t \times Suppl\_insurance_i \\
&+\beta_4 Time\_after00_t \times Suppl\_insurance_i + \beta_5 X_{it} + \beta_6 Year_t + \mu_{it}
\end{aligned}
$$

Medicare started to reimburse the PSA test for screening prostate cancer in 2000. The policy intervention is represented by post Medicare coverage periods when $Coverage00_t$ equals to 1 (Equation 3). Generally the Medigap plans are standardized nationally, except in the states of Massachusetts, Minnesota, and Wisconsin, where Medigap policies are subject to state-mandated benefits. Before Medicare extended the

benefit to pay for PSA testing, Medigap plans sold in Minnesota had included this benefit as the state has had an effective mandate since 1997. To eliminate the potential bias from supplemental private insurance that covered PSA testing before Medicare did, I excluded beneficiaries who had lived in MN since 1997 during the observation period.

Study Outcome

The main study outcome for colorectal cancer screening is the receipt of preventive colonoscopy within a year based on the medical claims[12] [13] – the most invasive and expensive screening among the Medicare covered procedures, yet one that provides full visualization to detect early cancer and to remove polyps and precancerous growths (NCI, 2011). Medicare reimburses screening colonoscopies at a frequency of once every 10 years, for beneficiaries at 50 years of age and older who are at normal risk of developing colon cancer.

In 1998, Medicare started to use the Health Care Financial Agency's common procedures coding system (HCPCS), using "G" codes to reimburse preventive cancer screenings. However, using merely HCPCS codes after the onset of Medicare coverage would underestimate the utilization. For example, if a polyp or lesion was identified during a screening colonoscopy and was removed or biopsied, providers were advised by CMS to bill the procedure under appropriate CPT codes. Following previously established algorithms, I have identified screening procedures from both CPT-4 codes

[12] MCBS data is limited in that the same individual is only interviewed for up to four years – too short for following the suggested 10 year interval for a preventive colonoscopy.
[13] A robustness test was performed using "unique beneficiary" as the unit of analysis. That allows me to model the utilization of colonoscopy up to past four years of each individual. The robustness test found similar results.

(44388-44394, 44397, 45355, 45378-45387, 45391, 45392) (HEDIS, 2007) and HCPCS codes (G0105, G0121) (Table 5).

Not surprisingly, few screening tests for colon or prostate cancer were observed in the FFS claims in the period before they were reimbursed (that is, before the introduction of new HCPCS screening codes). Many screening tests might have been performed, but given diagnosis of gastrointestinal symptoms to justify the claims submitted to Medicare. After 1998, it was likely that many colonoscopy procedures continued to be coded and billed as diagnostic screenings (Freeman et al, 2002). Due to these reasons, I did not attempt to distinguish screening procedures for asymptomatic patients.

However, isolating "diagnostic" tests used for patients whose claims indicated gastrointestinal symptoms was feasible. Medical procedures, including colonoscopies, furnished in order to investigate the cause of symptoms are consistently covered by Medicare Part B as outpatient services, regardless of the coverage benefits of preventive screenings. I assume a colonoscopy to be "diagnostic" if the claim is associated with common gastrointestinal symptoms, using diagnostic codes listed in Table 5 That allows me to observe trends of "diagnostic" tests from before the expansion to preventive screening and afterwards.

PSA Test

The primary outcome of interest for prostate cancer screening is having had a PSA test within the past year based on medical claims. This has been the most common

screening to detect early prostate cancer[14]. The PSA test can be a preventive or diagnostic procedure, or used to monitor cancer recurrence among men who were previously diagnosed with prostate cancer. To align with the BBA Medicare expansion, we have limited the study sample to those who did not have a history of prostate cancer, as documented in claims or survey. In a manner consistent with the identifying colonoscopy, I have searched the PSA procedure using both CPT-4 (84153) and HCPCS codes (G0103) (Table 6).

RESULTS

Characteristics of Study Sample

There were 152,409 beneficiaries (person-year) at normal risk of developing colon cancer, in the study samples of preventive colonoscopy. The average age was 74 years old. Shown in Table 7, the majority of them were white, living in metro areas, and slightly over half of them were female. Over 60% of the sample had not obtained a college education, and approximately 16% reported not being satisfied with their doctor-patient communications. 80% of these beneficiaries supplemented their FFS plans with additional private insurance. The study sample for PSA screening shares similar characteristics (59,635 person-years), except that the sample only contains male beneficiaries.

[14] Many other factors lead into furnishing a DRE on a patient, to detect colon disease for example; therefore our study does not consider utilization of DRE as an outcome of interest for prostate cancer screening.

In Figure 3, I showed the trend of receiving colonoscopy over years of 1992-2008. Overall, I observed 6.90% of normal risk beneficiaries who were 50 years of age and older underwent a colonoscopy each year, on average. This translates into 69% of beneficiaries receiving the test over 10 years[15]. Generally we observed long-lasting and large increases in the average observable utilization. The screening rate of colonoscopy in 2008 was roughly six times the rate in 1992. It is noticeable that the *observed* utilization increased sharply in year 1998, of the same year when Medicare coverage expanded to high risk beneficiaries.

Figure 4 presents the same trend of colonoscopy consumption for beneficiaries with supplemental insurance and for those without. Interestingly the utilization trend was similar prior to year 1998 but markedly different afterwards. Similarly, Figure 5 characterizes the utilization pattern for four income categories: high income, mid income, near poor, and poor beneficiaries. The visual patterns were generally consistent with that of Figure 3. However, gaps of utilization were minimal among the four income groups but widened substantially in the most recent decade in years post Medicare coverage. Similar trend is observed in Figure 6, where utilization patterns differ by education attainment. This implies exacerbated, instead of narrowed, disparities in preventive colonoscopy consumption.

The PSA test gained much popularity in the early 90s, when the FDA approved the patent for cancer screening in 1994. Figure 7 showed that the increasing trend

[15] The result is supported by similar findings from the Behavioral Risk Factor Surveillance System. http://www.ncsl.org/issues-research/health/colorectal-cancer-screening-laws-by-state.aspx

accelerated in 1998, but slowed down in recent years, possibly due to the controversies regarding the test's potential harm and its effectiveness to detect early cancers. Beneficiaries who purchased private supplemental insurance share a similar utilization trend with those who did not, both before and after the onset of Medicare coverage (Figure 8).

Marginal Effects of Medicare Coverage

Table 8 shows the marginal effects and standard errors of the explanatory variables on the probability of using colonoscopy or PSA testing. The columns presented marginal effect estimates from the interrupted series weighted Logit model, with the private insurance interaction. There is a strong, consistent, and statistically significant relationship between the onset of Medicare benefits for high-risk enrollees in 1998 and the observation of colonoscopy in claims. Among Medicare beneficiaries the probability of receiving a colonoscopy increased by almost 5 percentage points. The secular year trend does not explain any of the increment statistically. However, the further expansion in 2001 is not significantly related to use of colonoscopies. The trend of colonoscopy utilization increased faster after the 1998 policy change, compared to the years before (1.48 percentage points). Beneficiaries who purchased a supplemental plan were more likely to undergo a colonoscopy (2.35 percentage points). Estimates revealed both a large upward shift in the intercept after coverage, and a steeper slope after the coverage period (Figure 10).

To examine the effect of Medicare coverage on colonoscopy consumption up to the past four years (MCBS panel length), a robustness test is performed using "unique

beneficiary" and results presented similar impact of policy interventions in 1998 and 2001.

Another sensitivity test is carried out to examine possible changes of "diagnostic" colonoscopies before and after the coverage for screenings. The onset of coverage in 1998 was significantly associated with a 2.9-percentage-point increase in the probability of undergoing diagnostic colonoscopies (Figure 9). However, these statistics does not inform us whether the reimbursement policy change in 1998 has led to an increased utilization. It is possible that the policy change merely documented the existing screening procedures with the correct billing codes for preventive services. Although Medicare coverage of screening PSA test is not associated with the utilization, the estimates the probability decreases after year 2000 (-3.19 percentage points). Shown in Figure 11, increment in utilization is observed to slow down in more recent years.

Some socio-demographic and health style characteristics are significantly associated with the propensity to obtain the colonoscopy screening. In the interaction model, I found females were slightly more likely to undergo a colonoscopy (1.13 percentage points), relative to males. Non-black racial minorities, however, were less likely to use the test (-1.27 percentage points). Also, having a usual place of care was associated with an increase of about 4.33 percentage points in the probability of using a colonoscopy. Smoking also related to screening. Smokers at the time of the survey were less likely to have a colonoscopy (-2.02 percentage points). Other strong indicators of lower use of colonoscopy included being disabled (-3.13 percentage points), being poor

or near poor, having less than a high school education (-1.54 percentage points), or lacking English proficiency (-2.30 percentage points).

Some factors are significantly related to a reduced propensity for PSA testing consumption. For example, distrust toward one's doctor's professional skills is associated with a decreased likelihood of receiving the PSA test (-1.55 percentage points), and so is smoking (-3.51 percentage points), being disabled (-6.13 percentage points), being in lower income categories, and having attained less education. Having a usual place of care and being married increased the probability of using a PSA test (16.69 percentage points and 1.48 percentage points, respectively).

Analysis of Income Transfer

Medicare is a government-run health insurance program with several sources of financing: enrollee premiums, payroll taxes and general revenues. The payroll taxes contribute towards inpatient services (Part A), and Part B premium cost is mostly financed through general revenues (75%), with a smaller fraction financed by the monthly premiums paid by most beneficiaries[16] (25%).

In Chapter 2, I have discussed that one financial effect of mandated coverage is to shift the cost of preventive care from individually-borne, out-of-pocket costs to the premium, where the cost is shared by all enrollees. Prior to 2007, all beneficiaries paid same premiums for Medicare Part B and received similar coverage from the program.

[16] Beneficiaries who exceeded the high income thresholds had to pay 35%~80% of the total premium costs. The new premium structure did not start until 2007, planned to phase-in within three years. Year 2009 is the first year when the full percentage is used. (CMA, 2010).

The increased cost is shouldered by both enrollees and tax payers. In fact Part B enrollees are heavily subsidized by federal tax revenue. As a consequence, Medicare benefits expansion would result in large financial consequences to tax payers in general.

As noted earlier, purchase of the Medicare benefit is not voluntary yet consumption is highly discretionary. Medicare coverage for preventive care is not treated as a cash transfer (e.g. a lump-sum payment) to the covered beneficiaries. Rather, it subsidizes the price by reimbursing the expenditures that have actually occurred. Whereas the higher premiums fall on all enrollees, only a portion of Medicare enrollees actually will consume the preventive screening. That is, those who use services will be subsidized by those who do not and by general tax payers.

There have been conflicting findings on whether Medicare (Part A and Part B as a whole) is a regressive (McClellan & Skinner, 2006) or progressive program (Bhattacharya & Lakdawalla, 2006). Currently, little is known about the redistributive effects of Medicare coverage of preventive care. My analysis considers distributional effects as a form of income transfers in dollar values. The intergenerational transfer is not taken into account in this analysis. To simulate the amount of the transfers, I focus on the difference between subsidies received because of the coverage expansion for colonoscopy and the increased premiums. The analysis reveals some groups of beneficiaries receive more income transfers from the policy intervention, with an emphasis on the fact that groups have different likelihood of using the screenings.

Assume that all the subjects in the sample are in the same insurance pool across all states and all years. Assume further that all individuals pay the same premiums – the

new premium structure for high-income beneficiaries did not start in 2007 and only impacted less than 5% of the beneficiaries.

I estimate the income transfer by the following steps: (i). Characterize the beneficiaries who are more likely to receive a colonoscopy; (ii). Calculate the subsidy each sub-groups of beneficiaries received because of the coverage, based on their personal predicted probability of utilization; (iii). Calculate the share of increased premium each beneficiary paid out of pocket, with respect to the average predicted probability of utilization across years; (iv). The difference between subsidies and premiums are the net income transfers.

The income transfer is estimated by:

$$Transfer_i = Subsidy_i - \Delta premium = \Delta price \times phat_i - 0.25 \times \Delta price \times \overline{phat_i}$$

"0.25" is the proportion of cost increment shared by Part B beneficiaries. The unit price of colonoscopy is taken to be the average "Medicare Allowable" charges associated with the colonoscopy claims for an individual during a given year. The allowable charge is the Medicare-approved amount accepted by providers as full payment for covered services. For most services, patients still need to pay the 20 percent of allowable charges not paid by Medicare. For colonoscopy, beneficiaries are responsible for 25 percent of the allowable charge if the procedure is done in outpatient setting. Therefore, $\Delta price$ equals to 75 percent of the average allowable charge.

Estimations from a logit model $P(Y_{it} = 1 | X_{it}) = Logit(\beta_0 + \beta_1 X_{it} + \beta_2 Year_t + \mu_{it})$ in the post coverage period (after 1998) indicated that beneficiaries with certain characteristics face additional barriers to pursue colonoscopy. Those barriers are represented by socio-demographic characteristics such as being disabled, with only less than high school or high school education, being a non-black minority, and lack of English proficiency and being a smoker. As a contrary, some characteristics are associated with greater likelihood of receiving colonoscopy, including having a supplemental insurance, a usual place to go for care, living in metropolitan areas, married and being female.

If we treat the sample as a single insurance pool of Medicare's Part B program, the new coverage for colonoscopy would increase the annual beneficiary premium by $7.39 on average. To understand which beneficiaries benefit more from the expansion, Table 11 shows the subsidies and net income transfers for some of the selected subgroups.

The analysis indicated that beneficiaries who had additional access barriers received fewer subsidies from the program. I found that taxpayers are providing a larger subsidy to beneficiaries who are better-off than those who are worse off in terms of socio-demographic characteristics. For example, those who lack of English proficiency would only receive $15 subsidies and a negative net transfer. Similarly, having a usual source of care is associated with significantly more income transfers (28$ versus -$3 for those without a usual source of care). Beneficiaries who attained a college degree would receive $34 net income transfer on average, whereas those who only completed high

school receive $25 and those who had less than a high school degree receive only $ 11. Those advantageous characteristics interact with the amount of subsidies and income transfers, which suggests that beneficiaries with more advantageous characteristics, socio-demographically and behaviorally, benefited more from the Medicare coverage of preventive screenings in the analysis.

Charging higher premiums to beneficiaries above the income threshold would not solve this inequality. First, only some beneficiaries who fall into the highest income categories were required to pay more Part B premiums since 2007. By 2013, less than 5 percent of people with Medicare are affected by the income-related adjustments (SSA, 2013) and fewer were affected by 2008. Second, income-related premiums aim to address the intergenerational concerns that low-income workers subsidizing high-income seniors, as well as the intra-generational subsidies from high-income seniors to their low-income counterparts However, our analysis pointed out many other access barriers, some of which are related to income levels, play more significant roles than income on beneficiary's preventive care decision. Beneficiaries who are more subjected to these barriers would receive fewer subsidies and therefore less income transfers, regardless of the means-testing policy.

CONCLUSION

Expanding Medicare coverage to preventive colonoscopy screenings for detecting early colorectal cancer is found to increase their utilization. However, this is not the case for PSA testing used to detect prostate cancer. Results in Chapter 3 suggested that reimbursement from Medicare is the main driving source of the increment, while certain

demographic, socio-economic characteristics, and health behaviors, such as having a usual place of care, having higher socioeconomic status, and not smoking, are also strong indicators of receipt of care. Although Medicare coverage increased the likelihood of undergoing a colonoscopy, the analysis again reveals the redistributive effect of policy interventions – more income was transferred to those who pursued the care, and to those better-off ones rather than the worse-off beneficiaries.

CHAPTER 4. DISCUSSION

Reducing the out-of-pocket cost of preventive care has become a widely embraced public policy. The Patient Protection and Affordable Care Act (PPACA) of 2010 prioritized such a strategy by including specific provisions to require coverage of certain preventive services, including the preventive cancer screenings discussed here. Previously, reforms at the state level and within the Medicare program had mandated many of these screenings to be included in health plans. However, lack of understanding of the policy outcomes from previous policies leaves us with three compelling questions: how effective are mandates to increase preventive cancer screenings, who benefits from these mandates, and do the mandates result in progressive or regressive distributional effects?

Taking advantage of previous health care reform policies at the state and federal level, this project informs the likely effects of similar federal mandates created by PPACA. The project investigates the effect of insurance coverage mandates on consumption of preventive cancer screenings. Specifically, I made use of state variation in the timing of preventive cancer screening mandates, and the expanded Medicare coverage of preventive care, to study the consumption by privately insured adults and by Medicare fee-for-service beneficiaries, respectively.

The state level mandates did not increase rates of cancer screening. The Medicare coverage expansion because of BBA 1997 increased the rate of colonoscopy screening, but not the PSA screening. I do find, however, that mandated coverage can result in income transfers that are likely to be regressive and significant. Some individual and

social determinants are associated with large redistributive effects, including being an Asian, being less educated, lacking a usual source of care, and having less availability of physicians in the community. If these additional barriers are correlated with income, the result could be a regressive mandated benefit and a welfare loss for relatively lower income individuals. For those with employer-based coverage, the premiums are tax-deductible. Similarly, premiums for Medicare Part B and supplemental plans may be deducted from the federal tax as part of the allowable medical expense (cite AARP, 2009)[17]. Regressivity is exacerbated by the tax-deductibility of premiums, which is of greater benefit to the individuals in higher tax brackets (Dowd, 2007).

This study has several limitations. First, Medicare coverage of a certain preventive screening became effective for all eligible beneficiaries simultaneously, which rules out the availability of a control group for the study in Chapter 3. I was not able to assess whether the observed change in utilization was unique to these cancer screenings, or whether it is a trend in all health services. Second, the design of both studies relies on repeated cross-sections of respondents rather than analyses on the same respondents, observed before and after the implementation of the mandate. Third, it is beyond the scope of this project to follow the sequential procedures or trace a lifetime utilization of the preventive screenings. Utilization might be underestimated if the procedure is furnished at a time not observed in the data sets. The paper does not address the expenditures of follow-up tests after colonoscopy or PSA screening. When beneficiaries who are in higher income levels tend to live longer and collect more Medicare

[17] Beneficiaries can deduct only those expenses that exceed 7.5 percent of their annual adjusted gross income (AGI).

expenditures, there may be more income transferred to them. Fourth, detailed information on individuals' benefit designs, including cost-sharing requirements[18], are not available in the MEPS. Thus, the effect of state mandates could be attenuated if some respondents had coverage prior to the laws.

Fifth, MEPS or MCBS data does not distinguish preventive screenings from surveillance or diagnostic screenings. It may introduce measurement errors to the dependent variables when the probabilities of screenings capture these procedures done for other purposes. Moreover, another measurement issue is the extent to which self-reported data are considered to be accurate and reliable. Self-reported data, as in the case of MEPS, can be subject to recall bias especially when the survey is conducted after a significant time has elapsed after the event (e.g. colonoscopy). The recall bias also is more pronounced among poorer households (Das, Hammer & Sánchez-Paramo, 2012) . Another factor threatening the reliability of self-reported survey is socially-desirable-responding (SDR) – the desire of respondents to misreport their health care behaviors so as to portray healthier image. Studies have found that respondents under-reported socially undesirable and risky behaviors, e.g. illicit drug use (Tourangeau & Yan, 2007). Patients often over-reported their contact with general practitioners (Raina et al., 2002) as well as some cancer screening behaviors (Brown & Adams, 1992). Finally, there are slight differences between how the MEPS questionnaire asks respondents about cancer screenings and ACS cancer screening guidelines. Similarly, the MCBS claims were only

[18] The majority of state mandates did not remove deductibles or coinsurances, nor did they specify the amount of out-of-pocket costs from beneficiaries. However, some generous private plans voluntarily provided coverage for cancer screenings prior to state mandates, or covered the services on a first-dollar basis.

able to capture the yearly utilization that differs from the frequency Medicare actually reimbursed for.

The analysis only discusses distribution effects without exploring further for the welfare effects. To model the true welfare change, I would have to assume the estimated demand curve represents the true demand. That is only true when a. consumers are perfectly informed in the market; and b. the unit price of service is in fact the social cost. Neither of these conditions is met within the study sample. A true demand curve would lie higher than the estimated curve.

Although the differences-in-differences model controls for state characteristics, a drawback of all natural experiment designs relying on state policy changes is the potential endogeneity of the policy change. State laws may reflect the preferences of the population and/or particular interest groups. These preferences are not observed in the MEPS data. However, we compared *trends* of cancer screening utilizations between treatment and control states in the pre-mandate period, and we found no differences in those trends.

While reducing the out-of-pocket cost of preventive care has become a widely embraced public policy, rather than implementing mandates that increase premiums, the federal and state governments might consider alternative approaches. For example, policymakers might consider strategies to increase access to regular sources of care, establish education programs for consumers who are skeptical about preventive care or who have poor health literacy, subsidize interpreter services for consumers who have difficulty with English, and promote health and wellness in rural areas. These policies

also have distributional effects, but those effects are more likely to be progressive than regressive.

PPACA contains a dramatic expansion of preventive care coverage. Self-insured health plans that were formerly exempt from state mandates now must provide full coverage of many types of preventive care. Mandated coverage also raises new questions about the definition of preventive care. For example, the federal government recently ruled that if polyps are found during colonoscopies, the cost of removing the polyps also must be covered under the preventive care mandate, further adding to the cost of preventive care coverage (Kliff, 2013). In general, state and federal governments need to consider not only the first-order price effects of mandated coverage laws, but also the second-order distributional effects.

If these additional barriers and beliefs are correlated with income, the result could be a regressive mandated benefit and a welfare loss for relatively lower income individuals. For those with employer-based coverage, the regressivity is exacerbated by the tax-deductibility of employer-paid premiums, which is of greater benefit to the individuals in higher tax brackets[4]. For some consumers, eliminating the out-of-pocket price of preventive care alone may not be enough to promote additional utilization. Supplemental programs to eliminate additional barriers, such as transportation costs, inadequate information, and language difficulties, may be needed as well. Otherwise, the current disparities in health care utilization could be exacerbated by regressive income transfers as more vulnerable populations subsidize their better-off counterparts.

Table1. Sample Characteristics (Weighted Means), Years 1997-2008

	Eligible Beneficiaries: Colorectal Cancer Screening	Eligible Beneficiaries: Cervical Cancer Screening	Eligible Beneficiaries: Prostate Cancer Screening
Having had an endoscopy within past 5 years	0.38	…	…
Having had a Pap test within past year	…	0.68	
Having had a PSA within past year	…	…	0.50
Treatment group	0.58	0.67	0.67
Post mandate period	0.70	0.90	0.82
Female	0.51		
Age	56.2 (4.2)	41.70 (12.3)	56.01 (4.17)
Obtained less than high school education	0.03	0.02	0.04
Obtained high school education	0.37	0.36	0.36
Obtained college education	0.60	0.62	0.60
Black	0.08	0.10	0.07
Asian	0.04	0.05	0.04
Other race	0.01	0.02	0.01

White	0.87	0.83	0.88
Being married	0.75	0.64	0.81
Living in urban areas	0.82	0.84	0.82
Income based on FPL: Poor	0.02	0.03	0.02
Income based on FPL: Near poor	0.01	0.01	0.01
Income based on FPL: Low income	0.05	0.07	0.04
Income based on FPL: Mid income	0.26	0.33	0.24
Income based on FPL: High income	0.66	0.56	0.68
English not proficient	0.02	0.02	0.02
Unemployed some time	0.22	0.25	0.17
Self-rated health status: Excellent	0.23	0.29	0.24
Self-rated health status: Very good	0.37	0.38	0.36
Self-rated health status: Good	0.30	0.26	0.30
Self-rated health status: Fair	0.08	0.06	0.08
Self-rated health status: Poor	0.02	0.01	0.02
Having a usual place of care	0.89	0.86	0.87

Number of Gastroenterologist/100,000 population	4.01 (3.34)		
Number of Ob-gyn/100,000 population		13.67 (7.99)	
Number of Primary physician/100,000 population			31.32 (15.81)

Table 2. Marginal Effects of Covariates on Care Receipts Across All States in All Years

(Percentage Points Change, Robust Standard Errors)

Variables	Endoscopy with past 5 years	Pap test within past year	PSA test within past year
Treatment	-1.66***	0.43	1.42
	(0.78)	(0.58)	(1.13)
Post-Mandate	1.08	2.61	0.11
	(0.99)	(0.98)	(1.56)
Treatment*Post-Mandate	-1.53	2.01	0.97
	(1.63)	(2.35)	(2.89)
Female	-2.53***		
	(0.78)		
Age	1.68***	-0.22***	1.68
	(0.09)	(0.02)	(0.13)
Obtained less than high school education (Ref=College education)	-14.64***	-8.53***	-20.22***
	(1.83)	(1.79)	(2.61)
Obtained high school education	-5.85***	-7.32***	-9.00***
	(0.83)	(0.59)	(1.16)
Black (Ref=White)	0.22	5.04***	6.14***
	(1.02)	(0.79)	(1.71)

Asian	-11.94***	-12.41***	-16.40***
	(1.67)	(1.30)	(2.43)
Other race	-2.11	-3.51*	-3.66
	(3.13)	(2.01)	(4.58)
Being married	1.33	6.36***	5.33***
	(0.93)	(0.63)	(1.44)
Living in urban areas	3.48***	2.77***	-0.61
	(1.05)	(0.76)	(1.36)
Income based on FPL: Poor (Ref=High income)	-2.20	-0.83	-1.51
	(2.05)	(1.45)	(3.23)
Income based on FPL: Near poor	-8.23***	-2.98	-9.64**
	(2.63)	(1.84)	(4.35)
Income based on FPL: Low income	-7.71***	-4.10***	-4.85**
	(1.44)	(0.96)	(2.36)
Income based on FPL: Mid income	-7.07***	-3.85***	-7.37***
	(0.82)	(0.58)	(1.22)
English not proficient	-9.05***	0.96	-2.89
	(2.17)	(1.27)	(3.10)

Unemployed some time	3.19*** (0.96)	-3.38*** (0.63)	2.99** (1.47)
Self-rated health status: Very good (Ref=Excellent Health)	1.08 (0.92)	-0.61 (0.63)	0.03 (1.31)
Self-rated health status: Good	1.04 (0.99)	-1.36** (0.69)	-0.16 (1.39)
Self-rated health status: Fair	3.57** (1.48)	-3.00*** (1.14)	6.32*** (2.05)
Self-rated health status: Poor	8.01*** (2.61)	-4.28** (2.07)	3.42 (3.55)
Having a usual place of care	19.96*** (0.99)	11.87*** (0.79)	23.27*** (1.47)
Physician availability/100,000	0.72*** (0.13)	0.17*** (0.04)	-0.07* (0.04)
N	27,607	50,664	13,314
Pseudo R-Square	0.07	0.03	0.06

*Significance at 90% confidence intervals;** Significance at 95% confidence intervals; *** Significance at 99% confidence intervals

Table 3. Marginal Effects of Covariates on Probability of Receiving Care in Mandated States in Post Mandates Periods

(Percentage Points Change, Robust Standard Errors)

Variables	Endoscopy within past 5 years	Pap test within past year	PSA test within past year
Female	-2.84**		
	(1.24)		
Age	1.72***	-0.24***	1.57
	(0.14)	(0.03)	(0.17)
Obtained less than high school education (Ref=College education)	-13.00***	-6.04***	-15.78**
	(2.84)	(2.23)	(3.52)
Obtained high school education	-4.62***	-6.72***	-7.88***
	(1.33)	(0.77)	(1.56)
Black (Ref=White)	1.14	3.76***	6.25***
	(1.75)	(1.02)	(2.08)
Asian	-14.08***	-12.79***	-16.77***
	(2.20)	(1.51)	(2.78)
Other race	-1.59	-1.58	-10.74
	(4.16)	(2.67)	(11.87)
Being married	2.22	6.86***	4.63**
	(1.46)	(0.82)	(1.91)

	1.85	2.70***	-4.22**
Living in urban areas	(1.82)	(1.03)	(1.91)
Income based on FPL: Poor	-3.11	-0.53	-3.35
(Ref=High income)	(3.10)	(1.93)	(4.27)
Income based on FPL: Near poor	-8.12*	-2.16	-10.31
	(3.97)	(2.39)	(5.52)
Income based on FPL: Low income	-9.48***	-3.87***	-7.72***
	(2.17)	(1.25)	(2.92)
Income based on FPL: Mid income	-8.44***	-3.74***	-8.36***
	(1.31)	(0.75)	(1.63)
English not proficient	-8.21***	0.70	-4.09
	(2.96)	(1.56)	(3.78)
Unemployed some time	3.34**	-3.39***	0.83*
	(1.54)	(0.82)	(2.02)
Self-rated health status: Very good (Ref=Excellent Health)	1.39	-0.25	-1.36
	(1.46)	(0.81)	(1.73)
Self-rated health status: Good	0.24	-1.71	0.84

	(1.55)	(0.91)	(1.83)
Self-rated health status: Fair	4.44*	-3.86***	6.00**
	(2.31)	(1.51)	(2.73)
Self-rated health status: Poor	5.13	-3.07	4.80
	(4.11)	(2.85)	(5.25)
Having a usual place of care	19.49***	11.84***	24.61***
	(1.57)	(1.07)	(1.95)
Physician availability/100,000	0.82***	0.17***	0.03
	(0.23)	(0.05)	(0.03)
N	11,069	27,992	7,617
Pseudo R-Square	0.06	0.03	0.06

* Significance at 90% confidence intervals; ** Significance at 95% confidence intervals; *** Significance at 99% confidence intervals

Table 4. Average Income Transfers of Mandates for Colonoscopy by Access Characteristics Across All Years

Characteristics	Subsidies ($)	Net Income Transfers ($)
Female**	330.03	-23.71
Less than high school***	186.48	-167.26
High school***	307.16	-46.58
Black	343.98	-9.76
Asian***	230.61	-123.13
Other race	321.08	-32.66
Poor	347.87	-5.88
Near poor	267.00	-86.74
Low income***	246.55	-107.20
Mid income***	273.86	-79.89
English not proficient***	194.13	-159.62
Having a usual source of care***	-159.61	7.22

***significant at 0.01; **significant at 0.05

Table 5. Medicare Coverage of Preventive Colorectal and Prostate Cancer Screenings

Cancer Site	Population	Procedure	Frequency	Out-of-pocket cost
Colorectal	Men and women, age 50+	Screening colonoscopy	Every 10 years (Every 2 years for high risk beneficiaries)	25% coinsurance after Part B deductible met ǂ
		Fecal occult blood test (FOBT) with written order: a guaiac-based test, or an immunoassay (or immunochemical) test	Annual	None
		Flexible sigmoidoscopy	Every 4 years	25% coinsurance after Part B deductible met ǂ
		Screening barium enema as an alternative to a screening flexible sigmoidoscopy or screening colonoscopy	Every 4 years (Every 2 years for high risk beneficiaries)	25% coinsurance after Part B deductible met ǂ
Prostate	Men, age 50+	Prostate-specific antigen test (PSA)	Annual	None
		Digital rectal examination (DRE)	Annual	20% coinsurance after Part B deductible met

ǂ: Effective January 1, 2007, CMS waved the annual Medicare Part B deductible for colorectal cancer screening tests billed with the HCPCS G-codes (CMS MLN, 2012).

Table 6. Algorithms to Identify Colonoscopy in Medicare Part B and Outpatient Claims

Excluded patients with total colectomy	CPT: 44150-44153, 44155-44158, 44210-44212 (HEDIS 2007)
Personal history of colon cancer	HCPCS code: G0213-G0215, G0231(HEDIS, 2007) ICD-9 code: 153.x, 154.0, 154.1, 197.5, V10.05 (HEDIS, 2007) 230.3, 230.4 (CMS, 2005)
History of colon polyps	V12.72 (Ko et al., 2002) 211.3, 211.4 (Ananthakrishnan et al., 2007)
Chronic Digestive Disease Conditions or Inflammatory Bowel Diseases	555.x, 556.x, (Ko et al., 2002; Ananthakrishnan, 2007), 558.2, 558.9 (CMS, 2005)
Symptoms that suggests "diagnostic" colonoscopies	ICD-9: Abdominal distension (787.3), abdominal pain (789.0x, 789.6x), abdominal swelling or mass (789.3), anemia (285.1 and 285.9), anorexia (783.0), bowel obstruction (560.9), change in bowel habits (787.x, 564.0), diarrhea (558.9 and 564.5), gastrointestinal bleeding (578.x), positive FOBT (792.1), hemorrhage of rectum and anus (569.3), iron-deficiency anemia (280.x), anemia, unspecified (285.9) and weight loss (783.2) (Cooper, 2004; Ko et al., 2002).

Colonoscopy	CPT: 44388-44394, 44397, 45355, 45378-45387, 45391, 45392 (HEDIS 2007; Gross et al., 2006; Ko et al., 2002) HCPCS: G0105 (high risk), G0121 (normal risk) ICD-9 procedure codes*: 45.23, 45.25, 45.41-45.43, and 48.36 (Gross et al., 2006; GEM)

*: cited sources do not agree very well whether we should use ICD-9 procedure codes to identify colonoscopies. I did not use the ICD-9 procedure codes because they are designed (and should be primarily used) for inpatient services.

Table 7. Algorithms to Identify PSA Testing in Medicare Part B and Outpatient Claims

Personal history of prostate cancer or cancer treatment	ICD-9: 185, V10.46 (malignant neoplasm of prostate) CPT: J1950, J9202, J9217, J9218 J9219 (Androgen Deprivation Therapy)
Excluded patients: Prostatectomy	ICD-9: 60.21, 60.29, 60.3-60.6, 60.61, 60.62, 60.69 (Walter, 2006); CPT: 55810, 55812, 55815, 55801, 55821, 55831, 55842, 55845 (Walter, 2006)
Prostate Specific Antigen (PSA) Blood Test	G0103, 84153 (CMS, 2005)

Table 8. Sample Characteristics Across Years 1992-2008 (Weighted Mean)

Variables	Sample for Colonoscopy (N=152,409)	Sample for Colonoscopy among supplemental plan holders (N=…)	Sample for Prostate-Specific Antigen Test (PSA) (N=59,635)	Sample for Prostate Specific Antigen Test (PSA) among supplemental plan holders (N=…)
Medicare coverage of colonoscopy 1998	0.56	0.56	…	…
Medicare coverage of colonoscopy 2001	0.38	0.37	…	…
Medicare coverage of PSA test 2000	…	…	0.40	0.43
Having had a colonoscopy in past claim year	0.07	0.08	…	…
Having had a PSA test in past claim year	…	…	0.26	0.29
Having a supplemental private insurance	0.80	…	0.77	…
Income level: poor	0.17	0.12	0.07	0.07

Income level: near poor	0.27	0.26	0.23	0.23
Income level: mid - income	0.31	0.34	0.38	0.38
Income level: high – income (Reference)	0.15	0.18	0.23	0.24
Current smoker	0.14	0.11	0.13	0.13
Attained education: less than high school	0.17	0.13	0.15	0.15
Attained education: high school	0.51	0.51	0.46	0.46
Attained education: college (Reference)	0.32	0.36	0.39	0.40
Being married	0.58	10.6	0.80	0.80
Age	73.90 (8.04)	74.44 (7.41)	73.39 (7.30)	73.46 (7.22)
Race: white (Reference)	0.89	0.91	0.94	0.93
Race: black	0.07	0.04	0.04	0.04
Race: other race	0.04	0.02	0.02	0.03

Female	0.56	0.57	…	…
Medicare Entitled because of disability	0.07	0.04	0.06	0.05
Living in metro areas	0.72	0.73	0.73	0.72
Self – reported health: excellent (Reference)	0.17	0.18	0.20	0.19
Self – reported health: very good	0.28	0.30	0.30	0.29
Self – reported health: good	0.31	0.31	0.32	0.32
Self – reported health: fair	0.17	0.15	0.13	0.15
Self – reported health: poor	0.07	0.06	0.05	0.06
English not proficient	0.03	0.01	0.01	0.01
Having a usual source of care	0.93	0.95	0.93	0.94
Distrust doctors of expertise	0.08	0.07	0.06	0.06

Lack of communication with doctors	0.16	0.16	0.15	0.15

Table 9. Marginal Effects of Medicare Coverage
(Percentage Points, Robust Standard Errors)

Explanatory Variables	**Colonoscopy** (N=150,767)	**PSA test** (N=51,626)
Medicare coverage of colonoscopy 1998	4.93*** (0.54)	…
Time after 1998	1.48** (0.32)	…
Medicare coverage of colonoscopy 2001	-1.67 (0.59)	…
Time after 2001	-1.00* (0.26)	…
Medicare coverage of PSA test 2000	…	2.32*(0.67)
Time after 2000	…	-3.19***(0.16)
Year	-0.06 (0.19)	3.61***(0.13)
Having a supplemental insurance	2.35*** (0.24)	7.69***(0.47)
Medicare coverage 98# Supplemental insurance	2.42 (0.85)	…
Medicare coverage 01# Supplemental insurance	-1.02 (1.42)	…
Time after coverage onset 98# Supplemental insurance	0.26***(0.64)	…
Time after coverage onset 01# Supplemental insurance	-0.05 (0.65)	…
Medicare coverage 00# Supplemental insurance	…	0.45 (1.20)

Time after coverage onset 00#Supplemental insurance	…	-1.21 (0.21)
Income level: poor	-1.21*** (0.42)	-3.94*** (0.82)
Income level: near poor	-0.81** (0.30)	-1.20** (0.57)
Income level: mid-income	0.01 (0.27)	0.31 (0.46)
Current smoker	-2.02*** (0.40)	-3.51*** (0.61)
Attained education: less than high school	-1.54*** (0.36)	-1.82*** (0.65)
Attained education: high school	-0.80*** (0.24)	-1.16*** (0.45)
Being married	0.37 (0.27)	1.48*** (0.49)
Age	-0.09*** (0.02)	0.03 (0.03)
Race: black	-0.17 (0.43)	-1.04 (0.93)
Race: other race	-1.27** (0.65)	-2.34* (1.22)
Female	1.13*** (0.23)	…
Medicare Entitled because of disability	-3.13*** (0.62)	-6.13***(1.04)
Living in metro areas	0.14 (0.23)	-1.02**(0.44)
Self – reported health: very good	1.31*** (0.36)	1.23** (0.54)

Self – reported health: good	2.25*** (0.34)	0.22 (0.56)
Self – reported health: fair	2.93*** (0.38)	-1.04** (0.66)
Self – reported health: poor	3.85*** (0.45)	-3.16*** (0.90)
English not proficient	-2.30** (0.98)	-0.35 (1.48)
Having a usual source of care	4.33*** (0.64)	16.69***(1.04)
Distrust toward doctors	0.18 (0.38)	-1.55** (0.76)
Not satisfied with health communication with doctors	-0.06 (0.27)	-0.02 (0.52)

***significant at 0.01; **significant at 0.05; *significant at 0.10

Table 10. Characteristics of Individuals Who Used Colonoscopy in Post Coverage Period

Explanatory Variables	Colonoscopy since 2001
Year	0.78*** (0.08)
Having a supplemental insurance	3.63*** (0.57)
Income level: poor	-1.18 (0.89)
Income level: near poor	-1.07* (0.58)
Income level: mid-income	0.27 (0.46)
Current smoker	-2.37*** (0.75)
Attained education: less than high school	-1.54*** (0.36)
Attained education: high school	-0.80*** (0.24)
Being married	1.20*** (0.45)
Age	-0.21*** (0.03)
Race: black	-0.83 (0.80)
Race: other race	-0.92 (1.31)

Female	1.61*** (0.41)
Medicare Entitled because of disability	-4.05*** (1.16)
Living in metro areas	0.60 (0.43)
Self – reported health: very good	1.05*(0.59)
Self – reported health: good	2.66*** (0.59)
Self – reported health: fair	2.54*** (0.70)
Self – reported health: poor	3.61*** (0.92)
English not proficient	-6.98*** (1.93)
Having a usual source of care	9.46*** (1.60)
Distrust toward doctors	1.00 (0.75)
Not satisfied with health communication with doctors	-0.47 (0.47)
Knowledge of Medicare program: some	-0.33(0.44)
Knowledge of Medicare program: poor	-1.48***(0.53)

***significant at 0.01; **significant at 0.05; *significant at 0.10

Table 11. Average Income Transfers of Medicare Coverage for Colonoscopy by Access Characteristics Across All Years

Characteristics	Subsidy($)	Net Income Transfer($)
Mid income	37.10	29.71
Near poor	24.05	16.66
Poor	14.84	7.45
Having supplemental insurance***	33.37	17.41
Obtained less than high school education***	15.15	7.75
Obtained high school education***	30.21	22.82
Black	24.22	16.83
Other race	16.40	9.01
Lack of English proficiency***	13.58	6.18
Disabled***	36.83	20.38
Health very good	41.59	25.15
Health good***	46.12	29.68
Health fair***	41.62	25.18

Health poor***	44.35	27.91
Having a usual source of care***	44.07	27.63
Some knowledge of Medicare program	45.39	28.95
Poor knowledge of Medicare program***	35.52	19.08

***significant at 0.01; **significant at 0.05

Figure1.Effective Years of Cervical Cancer Screening Laws by 2008

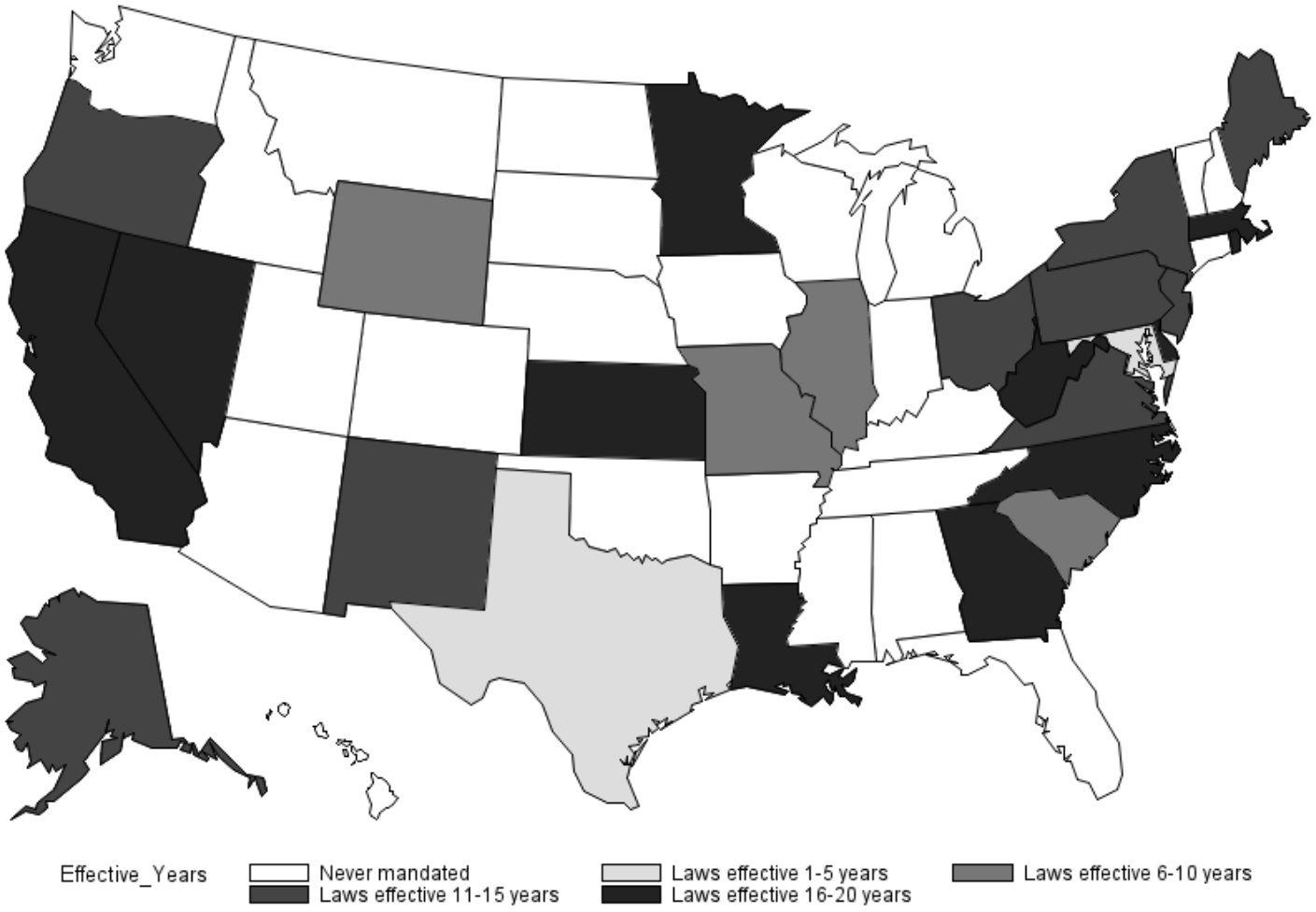
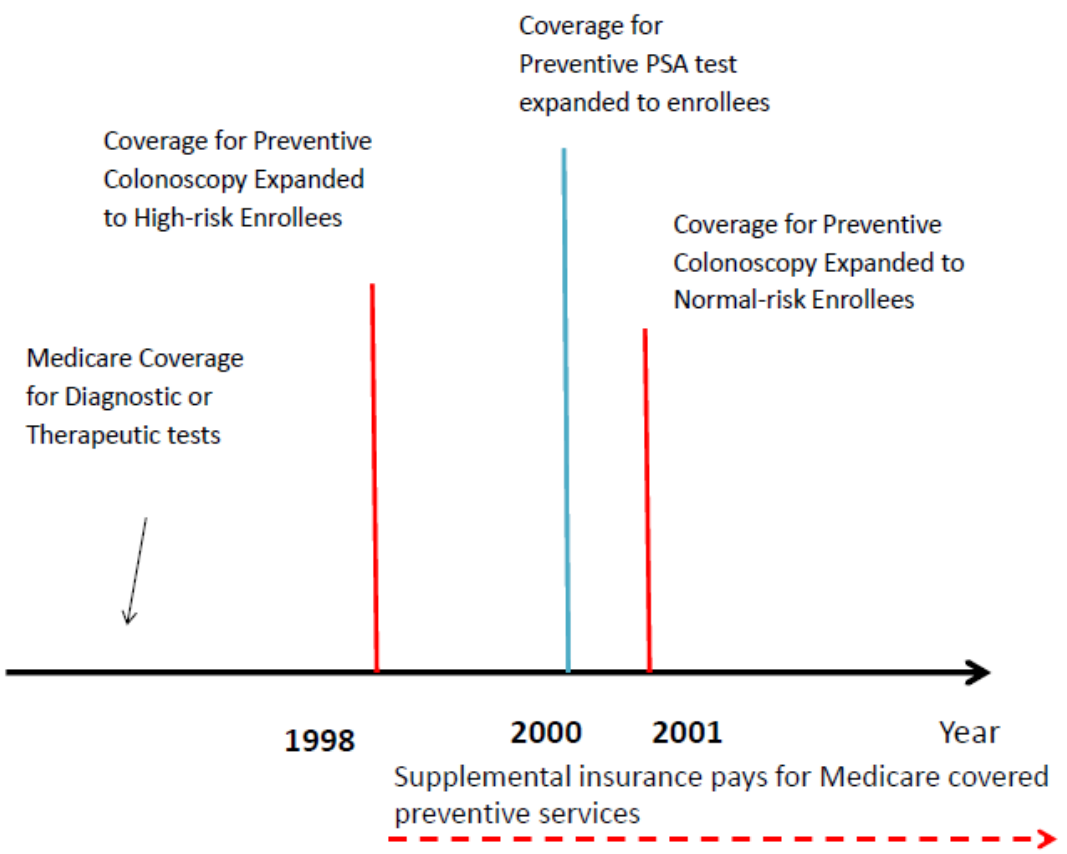


Figure 2. Two Coverage Expansions Changed Enrollee's Entitlement to Preventive Colonoscopy and PSA Screenings



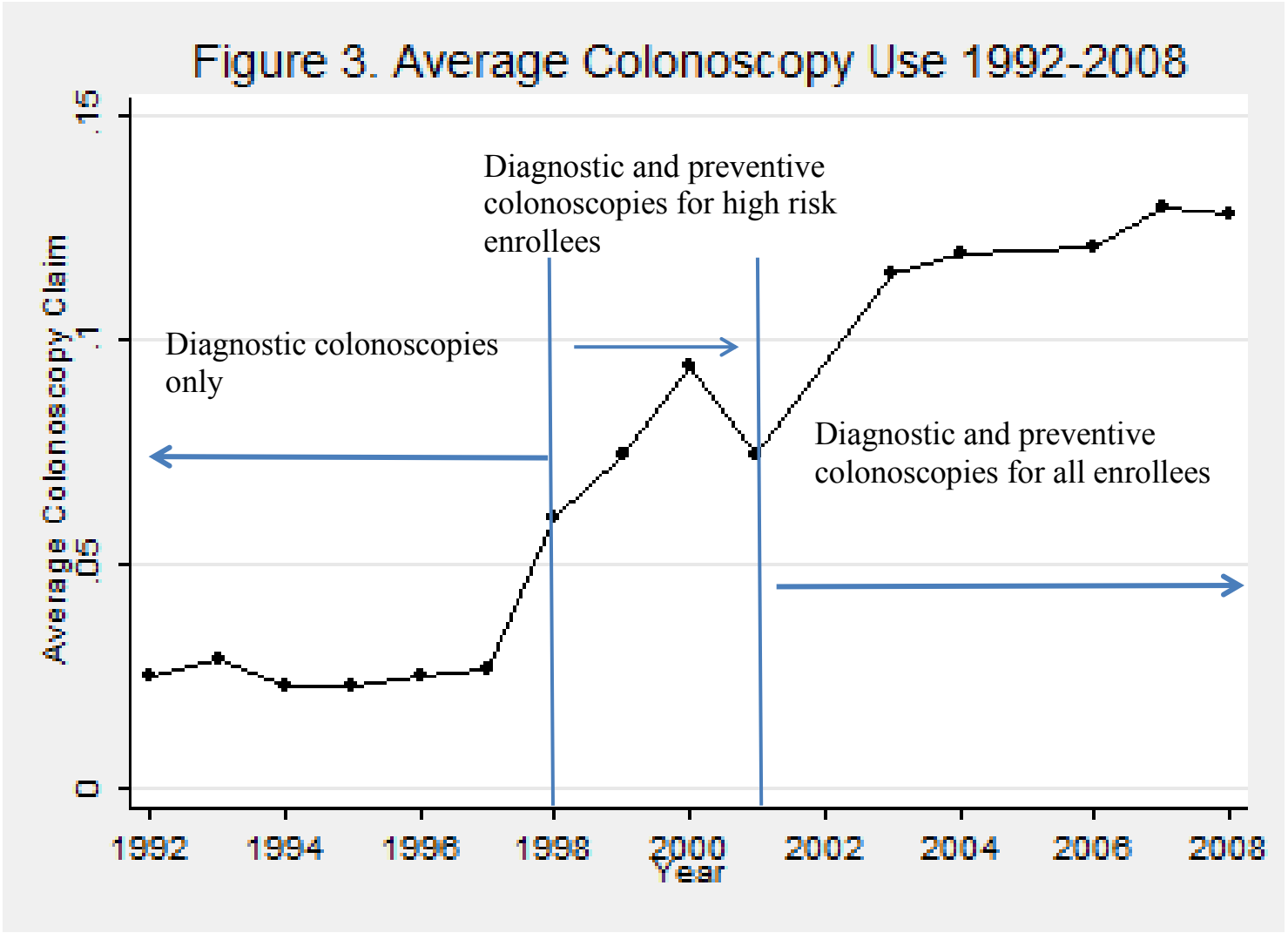


Figure 3. Average Colonoscopy Use 1992-2008
Average Colonoscopy Claim
0
.05
.1
.15
1992
1994
1996
1998
2000
2002
2004
2006
2008
Year
Diagnostic and preventive colonoscopies for high risk enrollees
Diagnostic colonoscopies only
Diagnostic and preventive colonoscopies for all enrollees

Figure 4. Average Colonoscopy Use 1992-2008 by Supplemental Plan Coverage

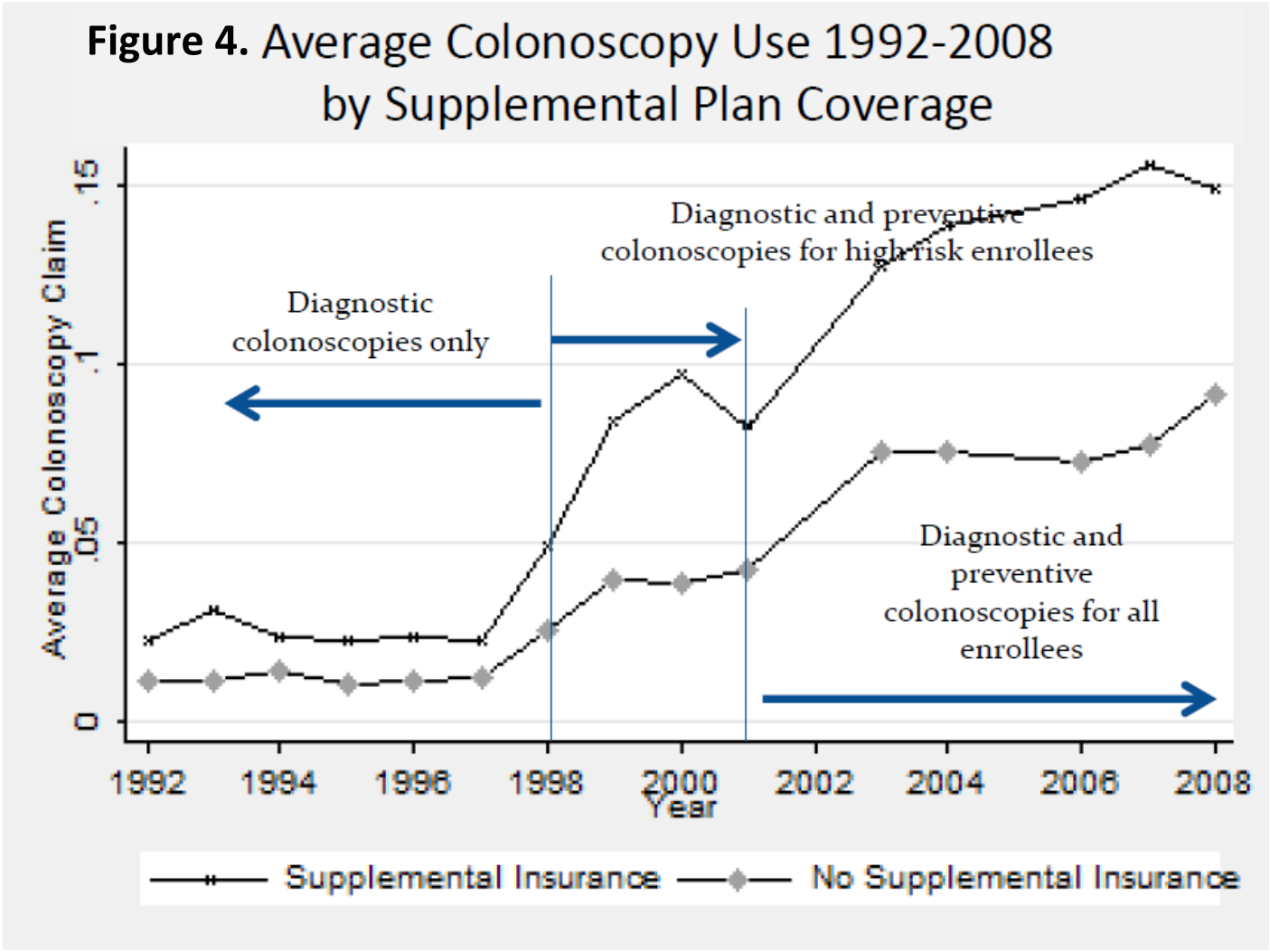


Figure 5. Average Colonoscopy Use 1992-2008 by Income

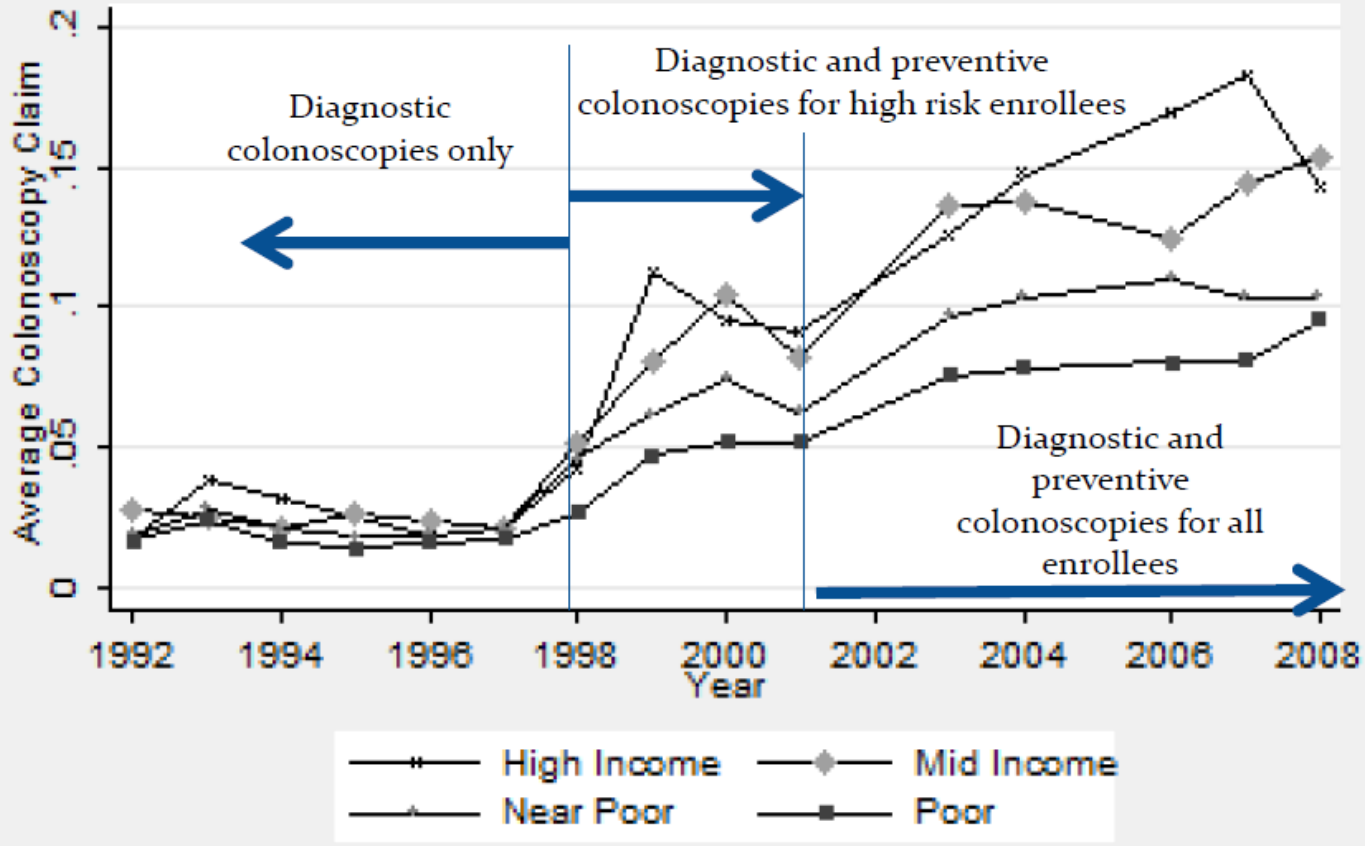
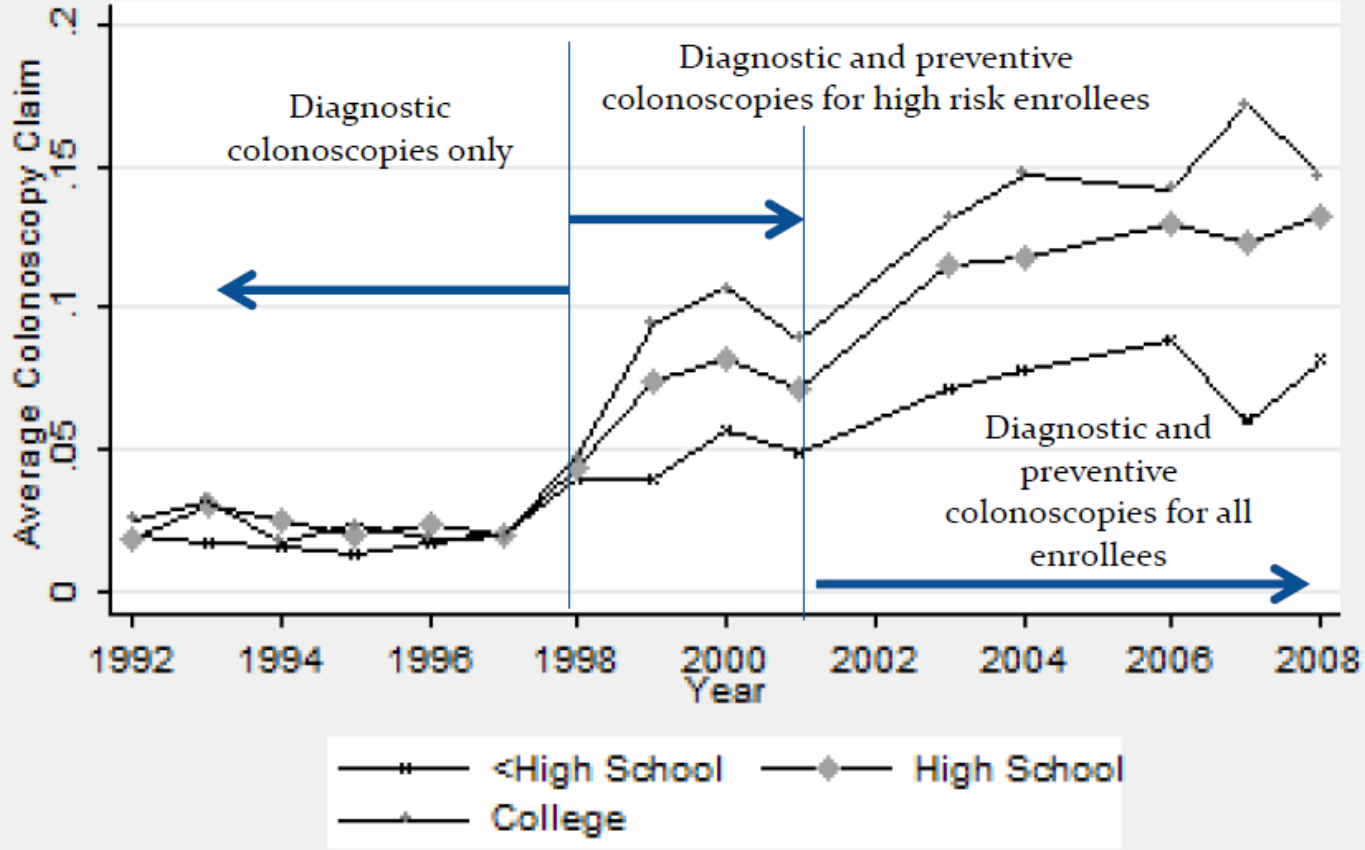


Figure 6. Average Colonoscopy Use 1992-2008 by Education



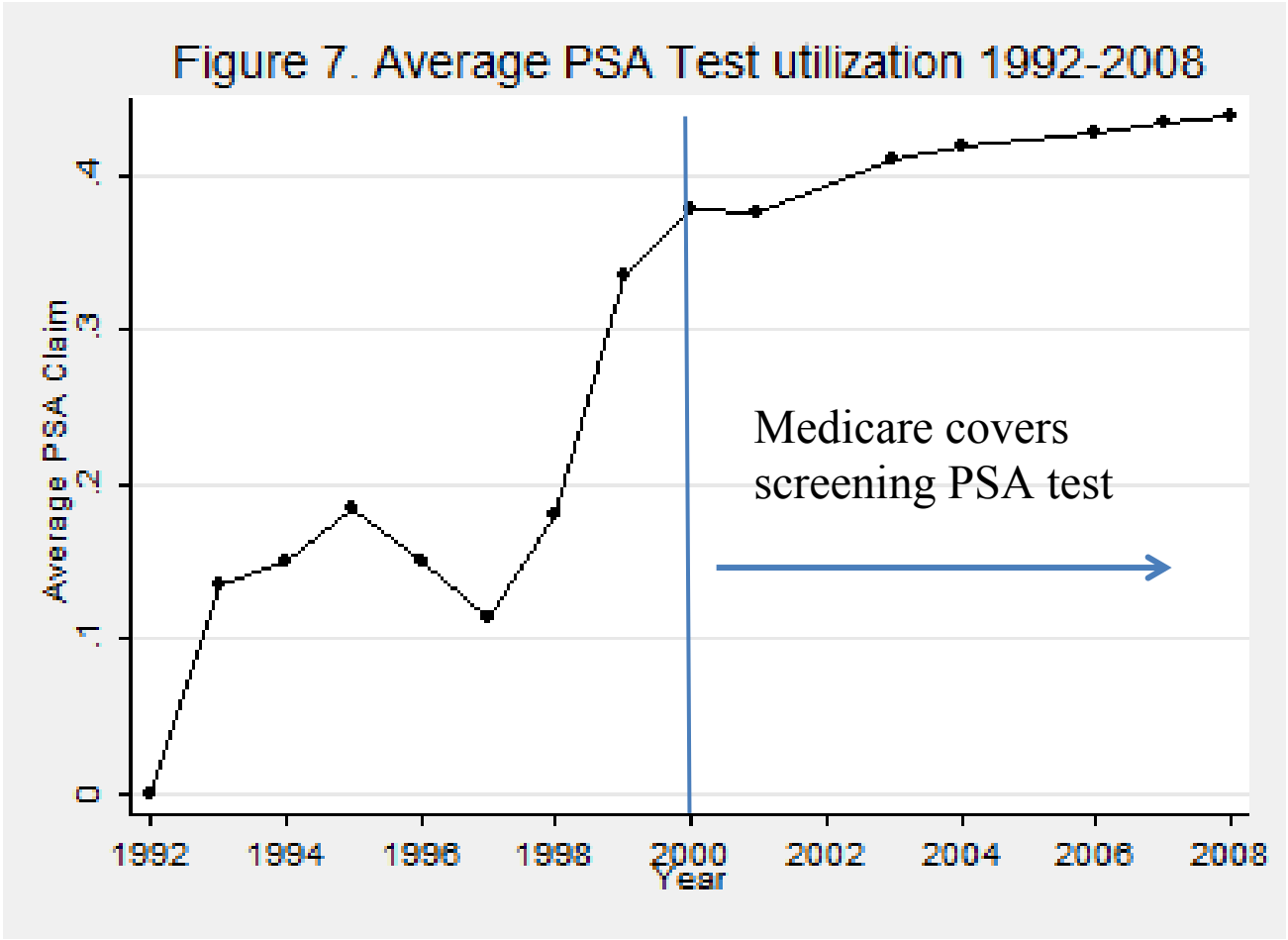


Figure 7. Average PSA Test utilization 1992-2008
Average PSA Claim
0
.1
.2
.3
.4
1992
1994
1996
1998
2000
2002
2004
2006
2008
Year
Medicare covers
screening PSA test

Figure 8. Average PSA Test Use 1992-2008 by Supplemental Plan Coverage

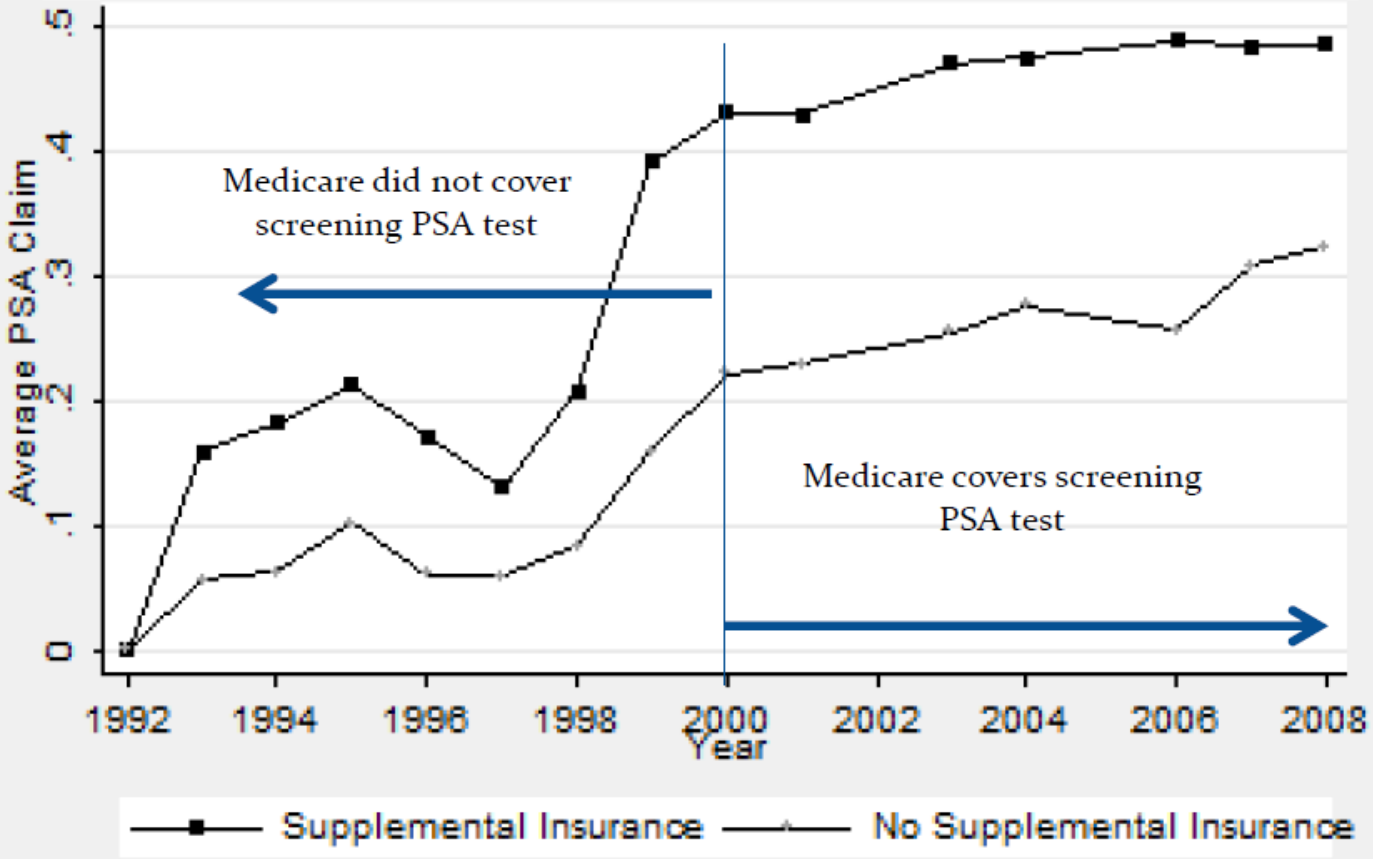


Figure 9. What did we observe?

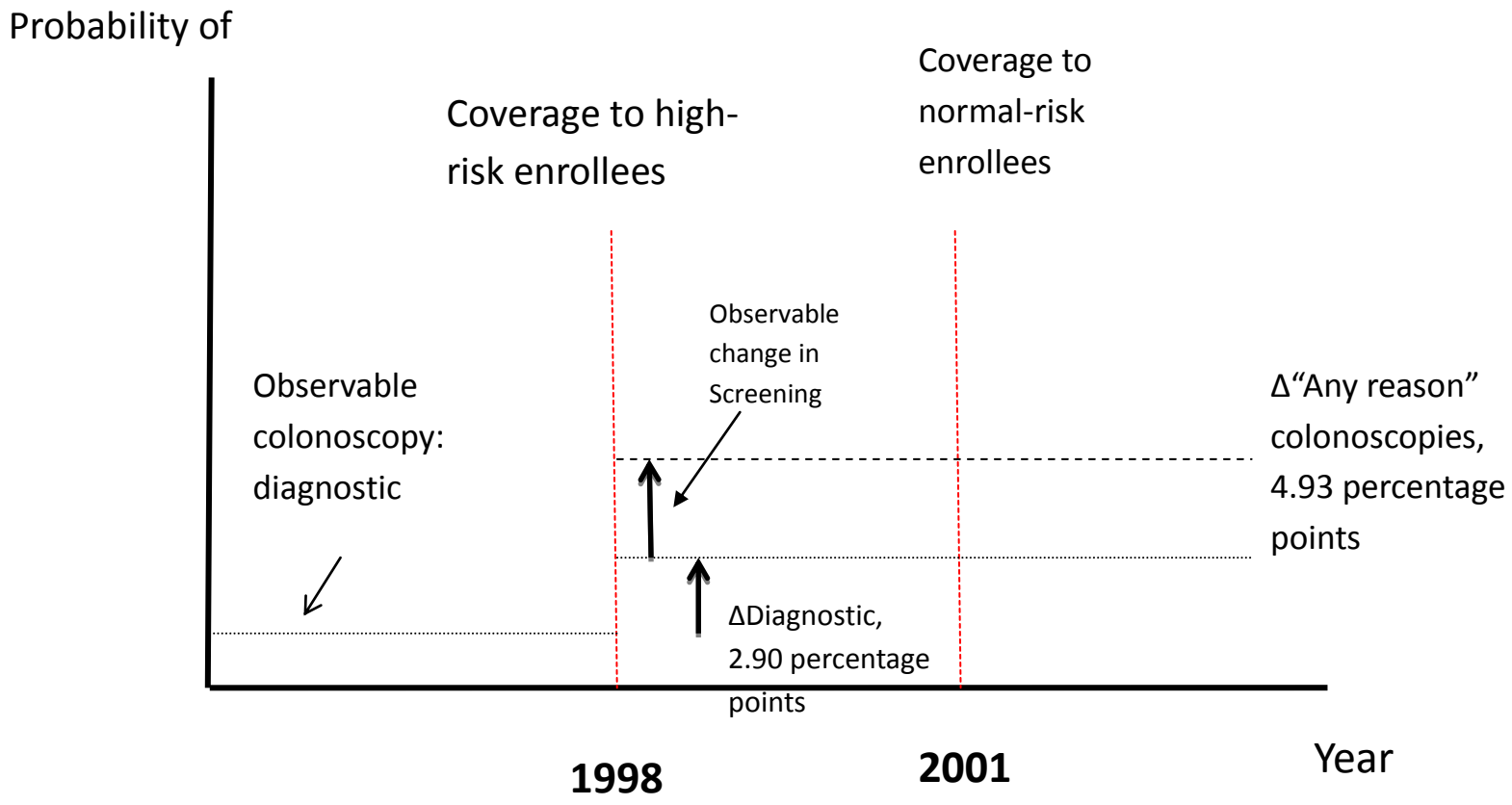
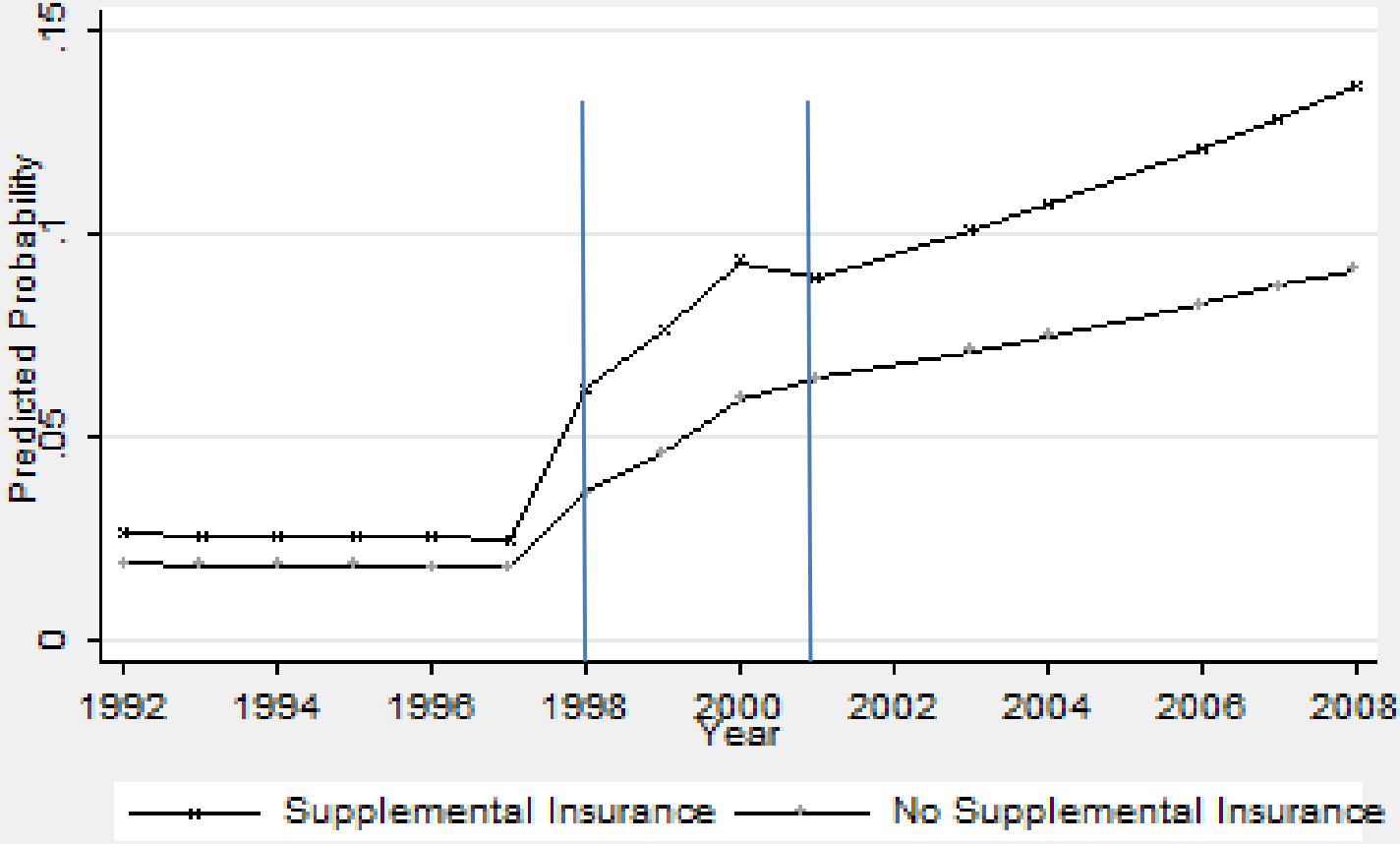


Figure 10. Predicted Probability of Receiving Colonoscopy By Insurance



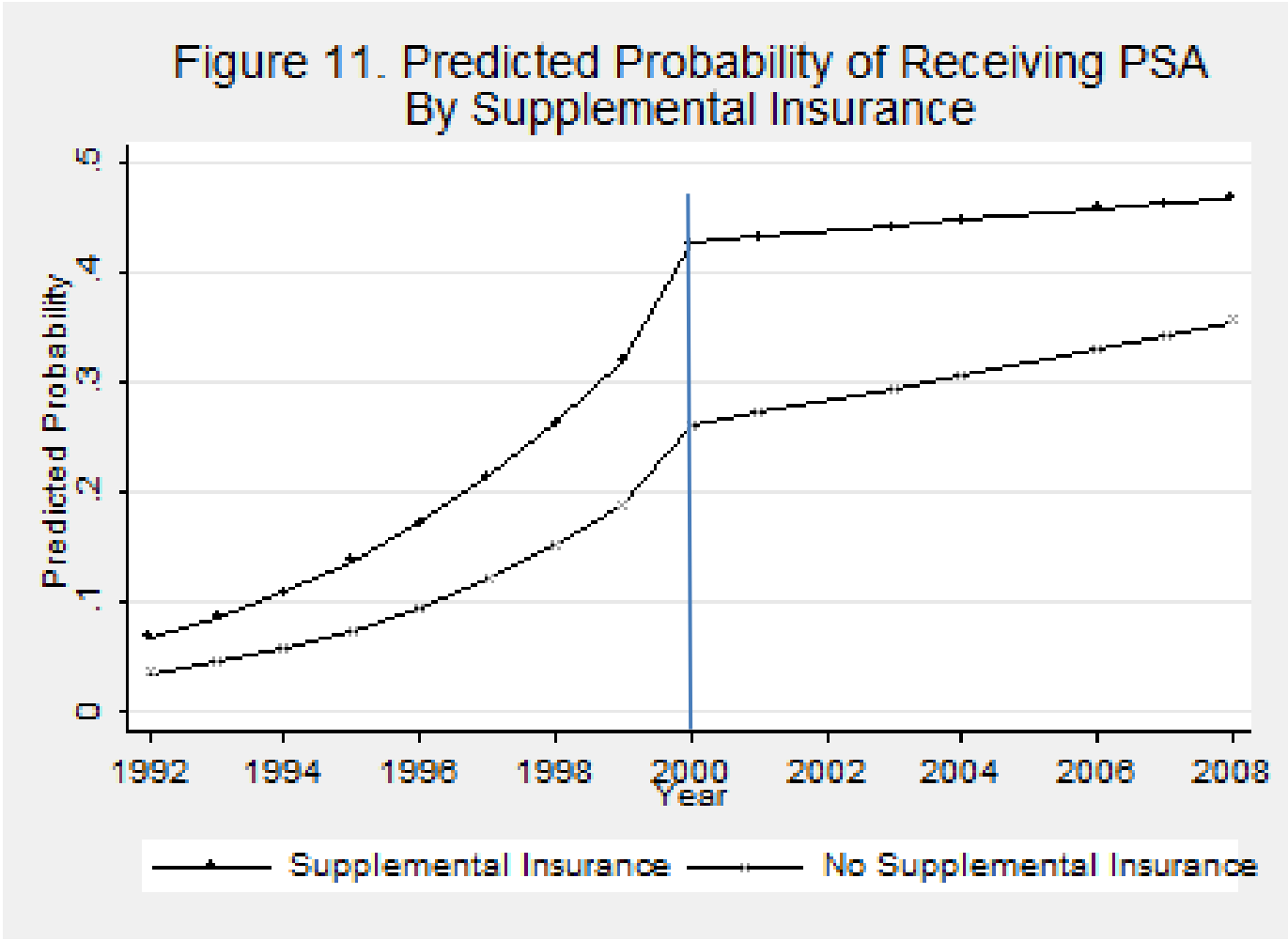


Figure 11. Predicted Probability of Receiving PSA
By Supplemental Insurance
Predicted Probability
0
.1
.2
.3
.4
.5
1992
1994
1996
1998
2000
2002
2004
2006
2008
Year
Supplemental Insurance
No Supplemental Insurance

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